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THE
# AMERICAN SURGEON

Vol. 21, No. 3 March, 1955

## FOREWORD

Progress in surgery within the last 30 years has been tremendous, and it has been aided so much by the contributions from the field of biochemistry that the older generation of surgeons should never cease to emphasize this fact, and the younger surgeons should familiarize themselves with the literature of the earlier decades of this century and thereby learn to appreciate more and more the contributions each generation of surgeons makes to the succeeding ones. In true Hippocratic traditions, surgeons have received from preceding generations knowledge, inspiration and training, have added improvements where possible, and then have passed these values on to the succeeding classes of surgeons, for the benefit of their patients and students.

It was not until after 1920 that the value of fluid balance, chemical levels and decompressive measures as applied to gastrointestinal surgery actually gathered momentum, and notable strides were made in their clinical application. In the next decade the sulfa compounds were added and we witnessed revolutionary methods in treating infections with comparable satisfactory results.

In the next decade came World War II and the antibiotics, and the care of wounded was elevated to a level never anticipated.

Medical schools and teaching hospitals and various educational associations have endeavored to maintain this high level of surgical proficiency and to advance it where possible.

In the wide domain of general surgery, old procedures have been extended and have been made safer. New areas have been explored and now provide new opportunities for much palliative and curative surgery. But the essence of surgical practice and teaching remains as it has been for many years—knowledge of facts, sound training, and a fearless application of the Golden Rule of surgery by the greatest number of surgeons possible. Only a small percentage of surgery performed in the United States is done at Medical School Hospitals. Therefore, education and practice must go hand in hand, and must spread over the country like beneficent sunshine. The surgical journal as a medium to disseminate surgical knowledge is of increasing value. The success of a new operative procedure,

a new remedy is proved when it can be applied by many in all areas. New knowledge in old heads and hands can work for much good.

C. REID EDWARDS, M.D.
*Professor of Surgery, and*
*Head of the Department*
*University of Maryland*
*School of Medicine*
*Baltimore, Maryland*

# USE OF HEMATOPORPHYRIN FLUORESCENCE IN BILIARY AND CANCER SURGERY*

GEORGE C. PECK, M.D.†, H. PATTERSON MACK, M.D.‡, WILLIAM A. HOLBROOK, M.D.†, FRANK H. J. FIGGE, PH.D.‡

*Baltimore*

Auler and Banzer[1] first demonstrated that porphyrins have a tendency to concentrate in neoplastic tissues. Figge, Weiland, and Manganiello[8, 11] later found independently that porphyrins tend to accumulate not only in neoplastic but also in embryonic and traumatized tissues. At this time, it was observed[8] also that the lymph nodes have an affinity for hematoporphyrin. This affinity of lymphoid tissues for porphyrin was so striking that experiments were planned to study this in more detail. It was realized that such a characteristic might be of practical value to facilitate the detection and removal of undesirable lymph nodes during operations on human subjects with cancer.

While the work on the fluorescence technic for detection of lymph nodes was in progress, it was noted that the gallbladder and the entire biliary tree became red fluorescent and quite conspicuous very soon after the injection of relatively large doses of hematoporphyrin into animals. Since the gallbladder and large and small bile ducts were delineated so clearly by the red fluorescence, it was thought that it would be possible to utilize this phenomenon in a practical way in surgery of the biliary tract and probably would be especially valuable in detecting anomalous conditions. These structures were, therefore, included in this study.

## METHODS AND MATERIALS

The observations to be reported here are based on experiments involving 5 human subjects, 6 dogs, 2 rabbits, and 100 mice. The hematoporphyrin was injected intravenously into the human subjects, dogs, rabbits, and 10 mice. Ninety mice received the hematoporphyrin either by intraperitoneal or subcutaneous injections. The dogs received 20–100 mg. of hematoporphyrin. Two rabbits received 30 mg. of hematoporphyrin each. The 5 human subjects were given 30, 40, 60, 120, and 1000 mg. of hematoporphyrin respectively. The mice received 0.5 to 10 mg. of hematoporphyrin per mouse.

Three of the 5 human subjects were examined by ultraviolet light in a darkened operating room. The cervical lymph nodes were removed from the fourth human being and were examined in a dark room under an ultraviolet light. The fifth human subject was used to study porphyrin clearance by the liver. This patient was convalescing from a cholecystectomy and common duct exploration. Fol-

* Supported by grants from the Anna Fuller Fund and the American Cancer Society, Maryland Division, Inc.

† From the Department of Surgery, University Hospital, Baltimore, Maryland.

‡ From the Department of Anatomy, University of Maryland, School of Medicine, Baltimore, Maryland.

lowing intravenous injection of hematoporphyrin, fractional T tube drainage specimens were collected over half hour intervals. By comparative fluorescence of these specimens of bile, the rapidity and rate of biliary porphyrin excretion was determined in a rough quantitative way by comparing the fluorescence intensity of the various samples of bile. The dogs were examined two days after the first injection of hematoporphyrin. They were anesthetized with nembutal to produce surgical anesthesia, and efforts were made to simulate the conditions of the hospital operating room. The abdomen was opened with a midline incision and the lymph nodes and biliary tree were examined for fluorescence. This examination to demonstrate fluorescence took place in an almost completely darkened room in a beam of near-ultraviolet black light (Figge[6]). The light was generated by a General Electric reflector spot quartz mercury-arc light, medical unit. Usually two or three such lights were used, in order to shorten exposure times for the photography of the fluorescence. Following examination of the abdominal lymph nodes and biliary tree, the femoral triangle and axillary regions were examined for fluorescent lymph nodes. In some of the dogs, a deep dissection of the neck also was performed, and the brain and spinal cord were examined. Approximately the same procedures were followed for the rabbits and mice.

The details of the photographic technic used have been described in previous papers (Figge and Clarke[7]). In brief, however, it has been found necessary to have an intense ultraviolet light source (usually one or more quartz mercury arcs emitting near-ultraviolet and visible light). Woods filters were placed in front of the mercury arcs to absorb the visible light. An orange-yellow filter was placed in front of the camera lens to exclude the ultraviolet light. This allows most of the visible light to pass through the camera lens to the film, but practically no ultraviolet light is transmitted. Only the visible light generated by the fluorescence of the object thus is recorded on the color film (see plate I).

## OBSERVATIONS

When mice were injected with more than 0.5 mg. of hematoporphyrin, almost the entire mouse became red fluorescent within an hour or two. It was noticed that the mice soon began to concentrate the porphyrin in the gallbladder. If mice were killed a few hours after injection, the gallbladder usually was seen as a very red fluorescent vesicle, and most of the tissues of the body were permeated with porphyrin and were, therefore, red fluorescent. After 24 to 48 hours, however, the porphyrin disappeared from most tissues but persisted in the lymph nodes. The lymph nodes therefore stood out as small red fluorescent globules in yellow fluorescent fat and were very conspicuous. While the observations in this present work were based on 100 mice, similar observations had been made on approximately 300 mice in experiments which preceded this.

In each of the dogs, it was found that hematoporphyrin accumulated in the lymph nodes and lymph vessels throughout the body of the animal. In each of the dogs, it also was observed that the gallbladder and biliary tree had become very red fluorescent. This fluorescence facilitated the visualization of these

structures which were rather obscure in artificial light. Each of these ducts was sharply outlined and could be easily identified and traced in their entire course through the gastrohepatic ligament from the hilus of the liver. It also was noted that the anatomic structure of the extrahepatic biliary system varied from that of human beings by the presence of numerous accessory hepatic ducts. Each of these was easily identifiable by fluorescence. One of the main advantages of this method would appear to be the fact that any anomalous condition would be easily detected.

It was found that in the animals which received 80 and 100 mg. of hematoporphyrin, lymph nodes were much more fluorescent than in the animals which had received 20 or 60 mg. In 1 of the dogs in which 100 Gm. of hematoporphyrin was given, it was found, upon deep dissection of the neck, that the tonsils were very red fluorescent. Characteristic observations are shown in figures 1, 2, 3, and 4 of plate I. A lymph node in the femoral triangle of a dog was photographed in visible light (fig. 1). The node appeared as a small, dark, brown mass in the lighter colored fascia and fat. The accumulation of porphyrin in such a lymph node makes it more conspicuous, even in visible light. The same lymph node was photographed in near ultraviolet light (fig. 2). The node appeared as a very conspicuous red fluorescent globular mass. While the afferent and efferent lymph vessels were not so conspicuous to the eye at the time of the examination, they appeared as red fluorescent lines in the photograph. The fascia had a bluish-white fluorescence, which was in contrast to the red fluorescent lymph node. A photograph of a mesenteric lymph node was taken in artificial visible light (fig. 3). The node was embedded in fat and not easily seen. When photographed in ultraviolet light (fig. 4), it stood out as a red fluorescent mass against a relatively dark but nonfluorescent background. In general, mesenteric lymph nodes became conspicuous because of their red fluorescence. The yellow fluorescent fat which surrounds them sometimes facilitates detection of nodes. The observations, with respect to lymph nodes in rabbits, were very much similar to those in dogs.

In the first 3 patients in whom this fluorescence method for the detection of lymph nodes was used, the observations that had been made in animals were not duplicated. The first 2 patients received 30 and 60 mg. of hematoporphyrin intravenously 24 hours prior to the operation. The third patient received 120 mg. over a period of two days prior to operation. It was thought that the original dose of 30 mg. may have been insufficient so the dose had been increased to 120 mg. When this dosage, which was thought to be sufficient, achieved no results, a further check of the records was made. This revealed that all 3 patients had received extensive roentgen radiation to the involved regions. It is well known that local roentgen radiation inhibits mitotic activity and growth in all tissues.[2, 3, 4, 5] The possibility that roentgen radiation might have suppressed or destroyed the affinity of the lymphoid tissue for porphyrin then was considered. Experiments were performed in which dogs and rabbits were irradiated over the inguinal and axillary regions of one side, while the remainder of the animal was protected with lead shields. This experiment showed that x-ray

radiation did not prevent the accumulation of porphyrin in the lymph nodes of the radiated parts. It was then believed that if hematoporphyrin was to be used in a practical way in human subjects, it would be necessary to determine the actual toxicity by gradually increasing the dosage.

The dose of 120 mg. to an adult human subject is very trivial compared with the doses customarily given to animals. It appeared unwise, however, to use a higher dosage in view of the strong emphasis put on its toxicity in the literature. The dangerous action of porphyrins presumably had been demonstrated by Meyer-Betz[12] in a self-injection experiment in 1913. In this single experiment, he had injected himself with 200 mg. of hematoporphyrin and became photosensitive to such a degree that exposure of parts of the body to sunlight resulted in great edema of those parts. Gaffron,[9] Harris,[10] and Smetana[14] indicated that the hematoporphyrin photosensitization is in some way related to a photoxidation of proteins in the skin. In all of these experiments, the photosensitizing agent was hematoporphyrin. Because of these reports of the photosensitizing action of hematoporphyrin, the therapeutic use of hematoporphyrin has been limited to 2 to 4 mg. per day as a maximum safe dose. Recently a study of the accumulation of porphyrins in neoplastic tissues in 11 human subjects revealed that by gradually increasing the dose, it was possible to give doses as high as 1,000 mg. over a period of about six hours (Rasmussen-Taxdal, Ward, & Figge[13]). While these higher dosages were far in excess of those thought to be toxic, there was no evidence of toxicity in any patient. It thus was possible to demonstrate an accumulation of hematoporphyrin in lymph nodes and neoplastic tissues of human subjects similar to that which had been observed in animals.

The fourth patient of this series was given 1000 mg. of hematoporphyrin intravenously. This is sufficient to make all the tissues of the body red fluorescent for a period up to 24 hours after the injection. The cervical carcinoma in this patient could be seen through the speculum as a brilliant red fluorescent mass. Inguinal lymph nodes were removed 48 hours following the injection of hematoporphyrin and were found to be red fluorescent, thus duplicating the results which had been found in animals.

Before extending this study into the field of biliary tract surgery, it was believed to be necessary to ascertain the rate of hematoporphyrin biliary excretion in human subjects. The fifth patient included in this study was given 40 mg. of hematoporphyrin intravenously. The fractional bile samples collected by means of T tube drainage of the common duct gave us the information that hematoporphyrin is excreted quickly in good concentration in the bile. In this patient, some of the hematoporphyrin appeared in the bile during the first hour after injection, but the maximum concentration of porphyrin in the bile was obtained in two to two and one-half hours. This indicates that a shorter time interval between the porphyrin injection and surgery perhaps is advisable, than the time interval (48 hours) deemed necessary for maximum lymph node or tumor differentiation and visualization. The degree of fluorescence of the bile specimens also indicates that smaller doses (20 to 40 mg.) of hematoporphyrin might be adequate for biliary tract visualization.

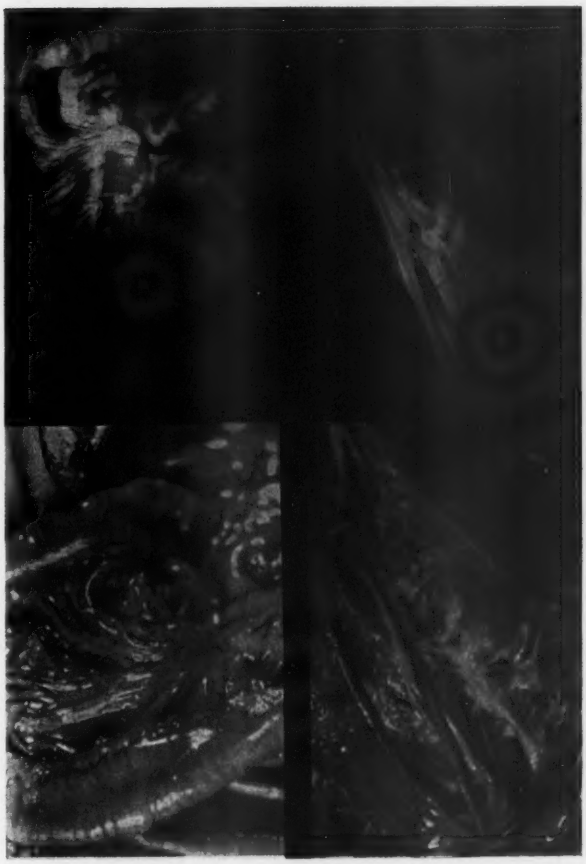

PLATE I

FIG. 1. (Lower right). Lymph node in femoral triangle of dog. Photographed in artificial light.

FIG. 2 (Upper right). Same as Figure 1. Note red fluorescent lymph node. Fluorescence photography—dark room, ultraviolet light.

FIG. 3. (Lower left). Mesenteric lymph node of dog. Photographed in artificial light.

FIG. 4 (Upper left). Same as Figure 3. Note red fluorescent lymph node. Fluorescence photography—dark room, ultraviolet light.

## SUMMARY AND CONCLUSIONS

When adequate quantities of hematoporphyrin were injected into mice, rabbits, dogs, and human subjects, the lymph nodes appeared more brilliantly red fluorescent than surrounding tissues. This procedure thus constitutes a method for detection of lymph nodes.

With certain precautions (tests for primary sensitivity) and care to prevent exposure of patients to sunlight, hematoporphyrin may be administered to human subjects in doses up to 1000 mg. In this dosage range (500 to 1000 mg.), neoplastic tissues and lymph nodes appear to be maximally differentiated from surrounding tissues 24 to 48 hours after the injection of the porphyrin. These structures exhibit a brilliant red fluorescence when illuminated with black (ultraviolet) light in a semidarkened room.

The gallbladder and entire biliary duct system also become brilliantly red fluorescent very soon after the injection of large doses of hematoporphyrin. It was noted, however, that the red fluorescence of the biliary tree appears much earlier than the fluorescence of the lymphatic structures. Determination of the rate of hematoporphyrin biliary excretion in a human subject with a T tube in the common duct revealed that the maximum concentration was attained two to two and one-half hours after injection of 40 mg. of hematoporphyrin.

It thus is evident that lymph nodes, neoplastic tissues, and the biliary tree may be detected and delineated by means of hematoporphyrin fluorescence methods. However, the dosage of hematoporphyrin required to visualize the biliary tree is much smaller (20 to 40 mg.) than that required for lymph nodes and neoplastic tissue. The time to obtain optimum results is only two to two and one-half hours as compared to 24 to 48 hours for demonstration of lymph nodes and neoplastic tissues.

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# THE EFFECTS OF AIR CONDITIONING ON OPERATING ROOM AIR CONTAMINATION

C. R. Edwards, M.D., C. W. McGrady, Jr., M.D., Audrey M. Funk, B.A.

*Baltimore*

Since the days of Lister, surgeons and operating room staffs have been trying to lessen the contamination of wounds by air borne pathogenic organisms. Hart,[1] in his extensive studies of more than 40 operating rooms over the country, has shown that the distribution of pathogenic bacteria in the air is fairly uniform. He showed also that micrococci in the air were present in greatest numbers during the colder months and in lowest numbers during the summer; these facts were correlated with the incidence of upper respiratory infections and wound infections.

In the present report, bacterial counts have been determined in four operating rooms before and after the installation of force draft air conditioning units. No attempt has been made to correlate wound infections to culture counts or respiratory infections, nor was any attempt made to sort the cases or prevent visitors.

## METHOD

In May and June of 1954 cultures were taken on open petri dishes of nutrient agar exposed for 30 minutes both in the morning and in the afternoon. Four dishes were placed on a ladder 6 feet tall with small holding shelves at 4 inch intervals. The petri dishes were placed at specific heights in each room, but varied from room to room. The height of the dishes from the floor varied from 28 to 72 inches. The ladder was moved about the room to 5 positions, as shown in figure 1. The exposed dishes then were incubated for 72 hours before the colonies were counted and identified. The air for the operating rooms at this time came through open windows in the steam rooms and through the open doors (fig. 1).

Shortly after the control studies were made, work was begun on sealing the windows and installing the air conditioning units with one room being closed at a time for this work. Following the completion of this work, the conditions in the rooms were allowed to stabilize for two weeks before our second set of studies was undertaken. Cultures were obtained also on the five wards in a manner similar to that used in the operating rooms. In addition to these, cultures were taken on Brewer's media and watched for growth of anaerobic organisms.

## DISCUSSION

In a general hospital of this size, and with 15 to 20 surgical cases of various types each day, it was of interest to determine the effects of air conditioning on the bacterial air count. We found essentially the same type of air contamina-

* Bacteriology supervisor.
From the University of Maryland School of Medicine, Baltimore, Maryland.

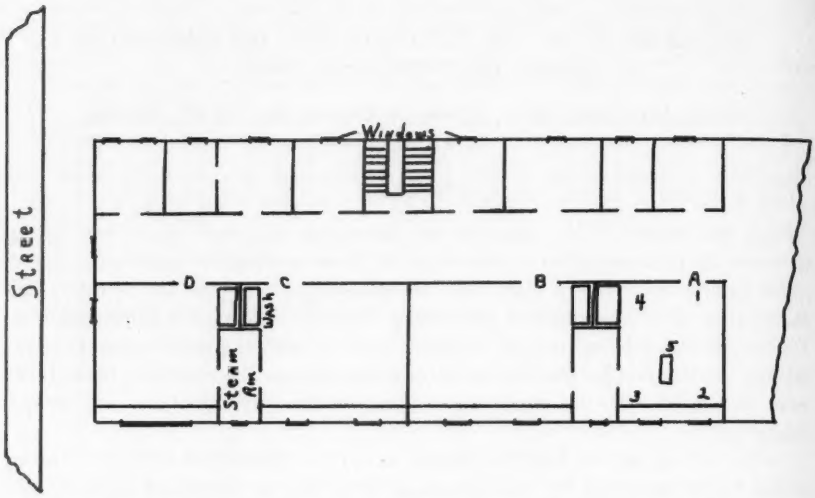


FIG. 1. This is the floor plan of the seventh floor operating suite showing the five positions where cultures were taken and the relationship of the windows and street to the operating rooms.

CHART 1

*Percentage of cultured organisms before and after air conditioning*

| | % Before | % After |
|---|---|---|
| Micrococcus pyogenes var aureus | 7.3 | 25.5 |
| Micrococcus pyogenes var albus | 39.0 | 31.0 |
| Micrococcus citreus | 0.9 | 5.9 |
| Gram positive rods | 50.0 | 35.5 |
| Molds | 2.0 | 1.7 |
| Clostridia | 0.0 | 0.0 |

tion as Hart (chart 1); in addition, our afternoon counts were on the whole much higher than the morning counts. When the afternoon counts were lower, it was noted that all operations had ended for the day in that particular room, or the room was in the process of being cleaned between operations.

In our control we found that room A was the most contaminated, as had been expected, because of its location close to the offices and to the rest of the hospital. Room C was the cleanest; rooms B and D had about the same amount of contamination. The relationship of the street to room D seemed to have no effect on the bacterial contamination.

All rooms have 22 feet ceilings with a six feet tile border extending up from the floor. The floors are washed between operations with Roccal*, and each night

* Ten per cent high molecular alkyl dimethyl benzol ammonium chloride and 90 per cent inert substance.

## CHART 2

*Colony count of each position before and after air conditioning (Each count represents a total colony count on four Petri dishes.)*

| Rm. | Time | Pos. | Count Before | Rm. | Time | Pos. | Count After |
|---|---|---|---|---|---|---|---|
| A | a.m. | 1 | 172 | A | a.m. | 1 | 30 |
| | | 2 | 184 | | | 2 | 50 |
| | | 3 | 95 | | | 3 | 45 |
| | | 4 | 91 | | | 4 | 130 |
| | | 5 | 80 | | | 5 | 83 |
| A | p.m. | 1 | 431 | A | p.m. | 1 | 58 |
| | | 2 | 73 | | | 2 | 49 |
| | | 3 | 27 | | | 3 | 53 |
| | | 4 | 72 | | | 4 | 56 |
| | | 5 | 185 | | | 5 | 50 |
| B | a.m. | 1 | 209 | B | a.m. | 1 | 43 |
| | | 2 | 310 | | | 2 | 34 |
| | | 3 | 112 | | | 3 | 15 |
| | | 4 | 190 | | | 4 | 24 |
| | | 5 | 155 | | | 5 | 66 |
| B | p.m. | 1 | 324 | B | p.m. | 1 | 44 |
| | | 2 | 142 | | | 2 | 40 |
| | | 3 | 138 | | | 3 | 42 |
| | | 4 | 60 | | | 4 | 40 |
| | | 5 | 273 | | | 5 | 135 |
| C | a.m. | 1 | 110 | C | a.m. | 1 | 80 |
| | | 2 | 17 | | | 2 | 166 |
| | | 3 | 48 | | | 3 | 60 |
| | | 4 | 26 | | | 4 | 275 |
| | | 5 | 35 | | | 5 | 38 |
| C | p.m. | 1 | 49 | C | p.m. | 1 | 81 |
| | | 2 | 48 | | | 2 | 65 |
| | | 3 | 51 | | | 3 | 17 |
| | | 4 | 114 | | | 4 | 220 |
| | | 5 | 41 | | | 5 | 90 |
| D | a.m. | 1 | 210 | D | a.m. | 1 | 42 |
| | | 2 | 81 | | | 2 | 91 |
| | | 3 | 44 | | | 3 | 26 |
| | | 4 | 53 | | | 4 | 71 |
| | | 5 | 49 | | | 5 | 99 |
| D | p.m. | 1 | 106 | D | p.m. | 1 | 31 |
| | | 2 | 151 | | | 2 | 30 |
| | | 3 | 79 | | | 3 | 19 |
| | | 4 | 75 | | | 4 | 38 |
| | | 5 | 141 | | | 5 | 102 |
| Total | | | 5106 | Total | | | 2728 |
| Average per Agar Dish | | | 128 | Average per Agar Dish | | | 68 |

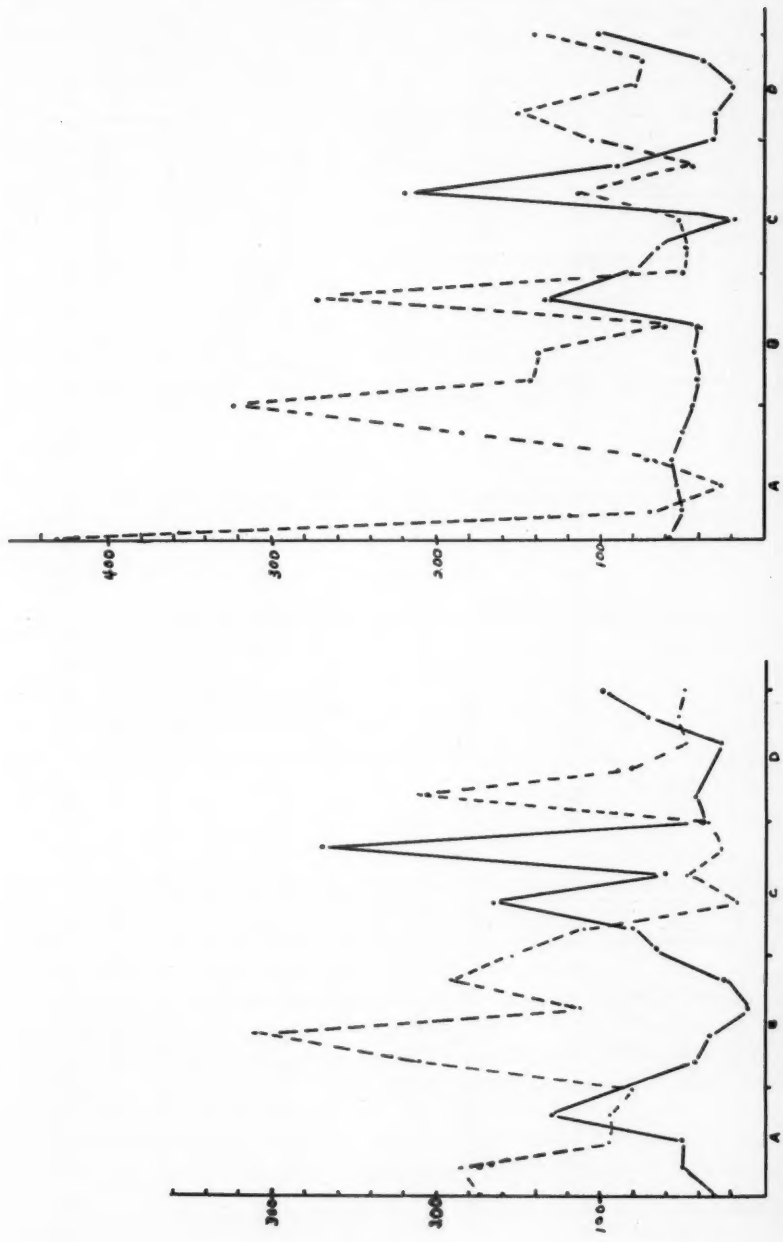


FIG. 2. Shows the a.m. colony counts before and after air-conditioning (left) and the p.m. colony counts before and after air-conditioning (right).

the tables and shelves are cleaned with Roccal. After dirty cases, everything is cleaned as described, but in the past few months, as a result of the work of C. W. Walters,[6] no period of room isolation has been observed. This method of cleaning the rooms was maintained before and after the installation of the air conditioning units, and while our petri dishes were being exposed.

There are two conditioning units which deliver 800 CFM of air to each room. This is considered substandard for most operating rooms, but because of the extremely high ceilings, this modification was allowed. Outside air is brought in and forced through an American Air Filter PL-24 fiber filters and a heating unit. From here the air passes through a water spray and over cooling units and is delivered to the operating rooms at 75 to 80 F. Air escapes through cracks around the hall doors and vents in the steam room doors.

In the postconditioning cultures, we found a 53 per cent reduction in the average colony count per position. For the control period the mean number of counts per position was 128 with a standard deviation of 92; for the postconditioning period, the mean number of counts per position was 68 with a standard deviation of 54. By Fischer's t-test, t is 3.65 and P is less than 0.01. This difference of the means could occur by chance less than once in a hundred. This difference is therefore considered highly significant. During these studies, no changes were made in the place of scrubbing, powdering of hands, or types of caps or masks worn. The results are presented in chart 2 and in graph form in figure 2. The graphs summarize the data obtained in the mornings and in the afternoons before and after conditioning. The peaks in C and D, after conditioning, occurred concomitantly with heating, because of cool days; the organism which was so greatly increased in number was Micrococcus citreus.

An attempt was made to correlate the numbers of colonies with the height of the petri dish from the floor. Cultures between 52 inches and 72 inches were compared with cultures from 28 inches to 52 inches above the floor. The mean at the two levels differed by only two to four colonies; this difference is not significant.

From cultures on the ward, we found a mean culture count per position to be 325. Thus, this suggests that the operating rooms, before conditioning, had approximately 60 per cent less contamination than the wards.

A second control was run on the hall after conditioning of the rooms, and the mean was 152 colonies per position. This is comparable to our standards before conditioning.

All cultures for anaerobic organisms were negative both before and after conditioning.

We believe that the favorable results reported here could be further improve with specially designed fiber filters or the newer electrical precipitation filters now in use in some areas.

FIG. 2. Shows the a.m. colony counts before and after air-conditioning (left) and the p.m. colony counts before and after air-conditioning (right).

## SUMMARY

The difference of air contamination before and after the installation of air conditioning in four operating rooms on a general surgical service has been investigated.

A 53 per cent reduction was found in total colony count per position in the operating room.

There was no significant difference in colony counts of cultures taken at different heights.

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# BALLOON STUDIES IN MEGACOLON

E. Roderick Shipley, M.D.*

*Baltimore*

Giant enlargement of the colon or megacolon is a clinical entity which may be due to any chronic obstruction, partial or intermittent, to the flow of feces through the large bowel. The chronic obstruction leads to a dilatation, elongation, and work hypertrophy of the more proximal bowel, especially marked in the circular muscular layer, but quite evident in all of the muscle coats. The causes of the obstruction are many and varied. Three major types of megacolon generally are recognized:[7] (1) organic or symptomatic megacolon, (2) aganglionic megacolon (true Hirschsprung's disease), and (3) idiopathic megacolon. By the use of balloon motility studies, it has been possible to further divide the aganglionic and idiopathic types of megacolon. These studies also aid in the selection of the proper treatment of any given case of giant colon.

Organic obstruction is familiar to the surgeon. A rectal stenosis, a slowly growing malignancy, or any slowly developing obstruction may lead to giant enlargement of the colon. Functional obstructions such as a dolichocolon with angulation and frequent self-limited volvulus of the bowel are frequently the factors responsible for a megacolon.

The absence of ganglion cells of Auerbach's plexus in cases of megacolon has been reported for many years.[1, 2, 8, 12] Whether this absence of the ganglion cells is the cause or result of the disease was not clear until the excellent work of Swenson and Neuhauser and others[10, 11] who noted that a lack of the ganglion cells of Auerbach's plexus of the distal colon would lead to a spastic contraction and obstruction in this portion of the colon. Swenson[10, 11] and Hiatt[5, 6] and others reported that removal of these aganglionic distal areas would result in marked improvement in most cases. Their work has shown that the absence of these ganglion cells is the probable cause of a type of giant colon, now known as aganglionic megacolon or Hirschsprung's disease.

Evidence has been presented by Etzel[3] that vitamin $B_1$ lack may impair the development or nutrition of the ganglion cells of the intestinal tract. This observer[3] noted that mega-esophagus, megacolon, pyloric achalasia, and megaureter may be due to varied manifestations of a degenerative disease of the autonomic intramural nervous system caused by a chronic deficiency of vitamin $B_1$. His patients not only were deficient in the $B_1$ vitamin, but they had been raised in an area where the diet was extremely high in carbohydrate which increased the daily need for the $B_1$ vitamin. A number of megacolon patients have been admitted to the University Hospital from an institution for mentally de-

* From the Departments of Surgery and Physiology, Schools of Medicine and Dentistry, University of Maryland, Baltimore, Maryland.

The author wishes to express his thanks to Mrs. Leah Proutt for her help in the preparation of this paper.

fective children, where the diet is high in carbohydrates and low in vitamins. This evidence certainly warrants much further study.

As in many diseases of obscure etiology, there is the group of patients in whom no demonstrable cause of colon enlargement is apparent. In this idiopathic group probably several causes of megacolon exist, but it is difficult to obtain detailed data since most of these patients do well on a simple medical regime, and since the number of patients available for study is small. In this group usually is classified the megacolon of the Mongolian idiot, of the hypothyroid, and of the patient with a spinal cord injury.

## PROCEDURE

It was hoped that various motility studies on a random group of patients with megacolon would aid in further knowledge of the disease and would aid in the selection of patients for surgery. Each patient chosen was studied in detail as to general health, body development, and mental ability. Histories obtained were quite complete and included an emotional as well as a physical evaluation. Barium enema studies were made by the Department of Radiology, using the technic as described by Neuhauser with which the radiologist was quite familiar. If, after these studies were complete, the diagnosis of megacolon was established, and shown not to be due to an organic or symptomatic cause, balloon studies were made.

Two thin-walled rubber balloons were placed in the distal colon in such a position that the upper balloon was in the large dilated segment and the lower balloon was in the distal smaller segment. Plastic tubing was led from the balloons to tambours which recorded intraluminal pressure changes on a smoked drum. The distance between the two balloons varied, but was between 6 to 12 centimeters. The balloons were inflated with air until a sensitive recording was obtained with both manometers when the patient coughed or pressure was placed over the lower abdomen.

Each patient had a cleansing enema the day prior to the test and was not allowed food or fluids for some eight hours prior to the test. After the initial recording was obtained, the patient was fed a regular breakfast in order to study the possible influence of the gastrocolic reflex.

## RESULTS

Those patients with an established diagnosis of a megacolon, not due to an organic cause, were easily divided into four groups by balloon motility studies.

One group of patients showed normal peristaltic activity in the proximal enlarged colon and a complete absence of activity in the distal portion (fig. 1). These tracings are similar to those reported by Swenson[10] and are thought to be typical of the recordings obtained from patients with the aganglionic type of megacolon. Postoperative examination of the resected distal colon from the patient whose tracing is reproduced showed an absence of the cells of the myenteric plexus.

A second group of patients showed peristaltic patterns both in the proximal

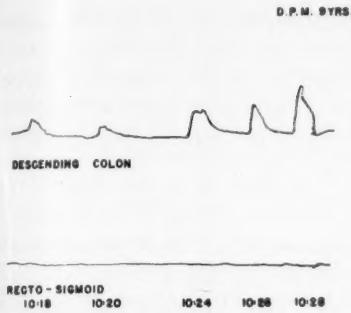


FIG. 1

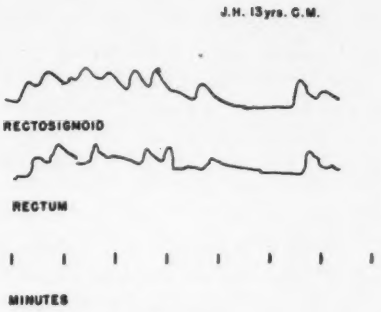


FIG. 2

FIG. 1. Aganglionic megacolon—Colonic activity is absent in the recto-sigmoid following peristaltic contractions of the proximal bowel.

FIG. 2. Propulsive megacolon—Peristaltic activity is present in the proximal colon and followed a little later by an active wave in the distal colon.

and distal segment. The pattern showed a propulsive nature since the distal recording of a pressure wave followed the proximal recording by a small interval of time depending directly on the distance between the balloons (fig. 2). Two of these patients expelled the balloons during the test. When these children were admitted to the hospital, successful completion of the act of defecation occurred only after the passage of many days or after repeated enemas. One patient in this group was operated upon and, although a successful Swenson operation was done, he returned to the hospital later having had no permanent benefit from the surgery.

The third group of tracings showed a lack of propulsion although pressure waves occurred in both segments. These patients showed no tendency to extrude the balloons. In this group there probably is a mass contractile activity of the

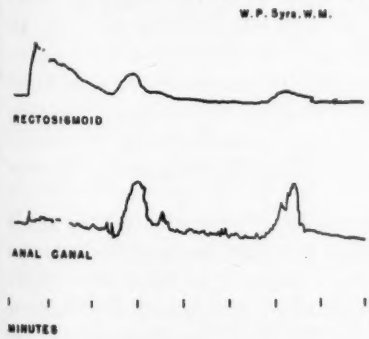


FIG. 3

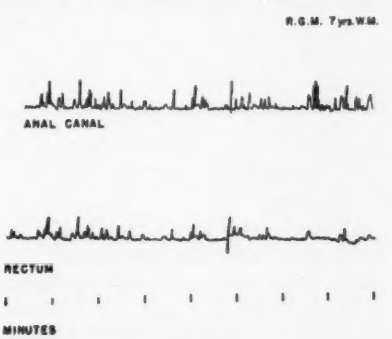


FIG. 4

FIG. 3. Spastic megacolon—Peristaltic activity is simultaneous in both the proximal and distal bowel and is nonpropulsive.

FIG. 4. Atonic megacolon—There is no evidence of peristaltic activity in either the proximal or distal segments of the colon.

involved colon (fig. 3). Hiatt[5] has suggested that this type of patient has a mass simultaneous spasm of the entire involved segment without effective propulsion.

The fourth type of pattern showed a generalized lack of colonic activity. There was no evidence of a normal peristaltic wave, and the usual activity of the entire colon studied was absent (fig. 4). Administration of mecholyl or food increased the tone but did not excite peristaltic activity.

## COMMENT

The act of defecation is a complex physiologic event. Any interruption to the normal sequence of events may lead to a chronic obstipation, a chronic obstruction, and an enlargement of the more proximal colon. Organic obstruction and functional obstruction are easily understood, but the cause of the large bowel dilatation in the absence of a clinically demonstrable lesion is complex and often confusing.

One type of neurogenic obstruction seems to be well established. The lack of ganglion cells of the myenteric plexus has been shown to lead to a megacolon and is rather successfully treated by resection of the distal aganglionic colon (type 1, fig. 1).

The three other types demonstrated by balloon studies present unusual problems. All of the patients in the propulsive or second group were of normal mentality and development, yet their bowel movements were infrequent and the bowel was dilated. In several of the cases, the children were from broken homes. These children developed an apparently normal bowel when the emotional conflict was removed and a good medical regime was instituted.

With the possible exception of the patients with true Hirschsprung's disease, there seems to be a series of events or a set of circumstances necessary for the development of the enlarged colon. Possibly no single entity may be the cause by itself, but a specific condition plus a second factor may lead to a megacolon. Lack of adequate propulsion is a defect of the large bowel; but certainly, this is of common occurrence in the constipated, yet megacolon seldom develops. An increased dryness of the stool, a lack of perception of the need to defecate, an increase in the sympathetic activity with resulting colonic spasm, or some other factor may cause the poorly propulsive bowel to dilate. It is conceivable then that the tendency toward slowin8 of the colonic fecal stream frequently is present, but a megacolon results only after the chronic sluggishness is augmented by some other factor.

Children with a lack of propulsive activity may be trained to aid the act of defecation. Training plus the use of lubricants and bulk producing drugs may make these children relatively normal in their habits. The child with absent propulsive activity may, by voluntary action of the abdominal and thoracic muscles, complete the act of defecation. The child must be taught to aid the natural process and not to fear it. If the training is inadequate, or impossible, the results will be disappointing.

The fourth type of patient, where there is no colonic activity demonstrable, presents a serious problem. Frequently, there is an associated mental defective-

ness. Dysfunction in the central nervous control of intestinal activity may be a major factor in this type of abnormality. Careful supervision and observation of the patient with the use of the usual medical regime may be successful, but the frequent use of stronger laxatives and enemas often must be instituted. The enlargement of the bowel in these patients easily is seen radiographically, but, as yet, the presence or absence of hypertrophy is not established by x-ray alone.

The treatment of choice in all types of megacolon is medical until it becomes obvious that the patient is not responding or is getting worse. If the medical regime is unsuccessful, then there are two paths from which to choose. If the patient is in the aganglionic group, certainly, some type of pull through operation should be considered. If the patient is in one of the three other groups, the pull through operation may be of but little benefit. In the latter groups, medical re-evaluation should be instituted to completely rule out any possible metabolic or organic cause of the megacolon. Spinal anesthesia, if successful in overcoming the obstruction, may indicate that a lumbar sympathectomy will yield satisfactory results. Partial colectomy may be of great benefit to these patients in whom a dilated elongated colon contains quantities of inspissated feces. The shortening of the large bowel may prevent the excessive reabsorption of water and may allow softer and easier bowel movements. That group of patients not falling into the aganglionic group must be carefully evaluated prior to deciding on any definite program. Re-education of the parents is to be considered. In some cases, advised removal of the patient from his surroundings to a place where emotional conflict may be avoided and where adequate medical care can be given may be indicated. Medical management, when adequate, usually is superior to surgery.

Adequate medical management should include three basic principles. The formation of good bowel habits is most important. A time should be chosen when the need for haste is absent and when the patient has just completed a meal. Parent training is just as important as patient training, and without adequate parental aid, the child will make little progress.

The use of mineral oil as a lubricant with the careful administration of a bulk producing hydrophilic colloid aids in the efficiency of the bowel. The mineral oils are best administered at night which will allow time for passage through the intestinal tract.

In order to prevent loss of the fat soluble vitamins, a multiple vitamin product is administered in the morning. A multiple vitamin product which is adequate in the thiamin and ascorbic acid content usually is advised. During the period of hospitalization, the vitamin supplement to the diet is augmented by parenteral vitamin B complex.

The use of plain water, soap suds, and other hypotonic or hypertonic enemas should be avoided. Hiatt[5] has pointed out that, in megacolon patients, tap water enemas may cause a precipitous fall in the plasma concentrations of sodium, potassium, and proteins. Death may follow the administration of such enemas if treatment is not rapid and adequate. Isotonic enemas are advised and will render the procedure without danger. Frequent enemas are advised early in the

medical management only. Later, once satisfactory bowel habit has been established, the enemas are given once a week to assure a cleansing of the colon. Even later, enemas may be discouraged if adequate bowel movements are assured.

Frequently, the use of a drug to increase the activity of the parasympathetic supply is quite successful. Drugs which act on the smooth muscle directly, or on the sympathetic nervous system may be adequate in the treatment of isolated cases. Medical management is to be preferred, and surgery is to be reserved for the nonresponsive patient.[4, 9]

SUMMARY

Colonic motility studies have been made on patients with the established diagnosis of neurogenic or idiopathic megacolon.

Four different motility patterns have been identified: a. aganglionic; b. propulsive; c. spastic; d. atonic.

Possibly more than one factor is responsible for the development of a dilated colon, and megacolon is the result of a set of circumstances. Any disturbance in the central or local control of the large intestine or abnormality of the colonic content may interrupt the normal process of defecation and may predispose to the development of a megacolon.

An outline of the medical management of megacolon is presented.

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# ESSENTIALS AND NONESSENTIALS OF COLONIC SURGERY*

MONTE EDWARDS, M.R.C.S., JOHN D. ROSIN, M.D.

*Baltimore*

After the usefulness of any therapeutic measure has been established, that measure becomes embodied in the routine of the day, and once adopted it may be difficult of removal. Periodically it becomes necessary to survey the situation, either to modify or to discard wherever needed and, at least, to attempt simplification. The means by which the operative mortality rate has been reduced in resection of the colon with primary anastomosis are generally conceded to be a proper maintenance of fluid and electrolyte balance, replacement of blood loss, exhibition of appropriate vitamins, adequate decompressive measures before and after operation, and disinfection of the bowel contents by antibiotics and sulfa drugs. All of these measures now are so much a part of daily routine that it is almost impossible to determine the essentiality of any one of them in terms of clinical results. But of them all, two deserve some rather careful scrutiny. That part of decompression involving the use of long intestinal suction tubes, and the chemical modification of the intestinal flora are in this category.

Some few years ago one of us saw fit to cast some doubt on the merits of preoperative chemical cleansing of the bowel contents.[3] There seemed to be some conflict in purpose between disinfection and decompression, and when there was any retardation of the bowel contents, decompression by every available means assumed the more important role. There arose the difficulty of restoring bowel continuity when good mechanical cleansing had not been done preoperatively. The oral administration of the bacteriostatic agent after operation also has presented some difficulties. Its absorption is bound to be interrupted probably by a more essential feature of postoperative care in the form of continuous gastric suction.

With the introduction of intravenous forms of tetracycline, chlortetracycline, and oxytetracycline it became possible to give the patient full benefit of these broad spectrum drugs with the certainty of their absorption and without the disagreeable side effects of oral administration. At one time, therefore, it became our routine to give a broad spectrum antibiotic orally before operation and to follow this with intravenous use of the same drug after operation. How much each contributed in maintaining bacteriostasis in the anastomotic line, in the peritoneum, or in the abdominal wound would be difficult to evaluate, but it is perfectly natural to move on to the next line of reasoning, that the intravenous drug might be all that is necessary.

It is now also a matter of general opinion that the broad spectrum antibiotics are responsible in some measure for two serious side effects, both apparently related to the suppression of normal intestinal flora and the overgrowth of undesirable elements in the bowel causing the ano-recto-colic syndrome, and pseudo-

* From the Department of Proctology, University of Maryland, Baltimore, Maryland.

membranous enterocolitis. The first intimation of this type of trouble came with the anal itching, burning, and seepage that resulted from use of these drugs independent of any operative procedure, then with the punishment to which an anastomotic line was exposed by the passage over it of a watery diarrhea, and finally with the necrotizing inflammation of which we are fortunate in having had little experience. Although pseudomembranous enterocolitis may not be caused entirely by antibiotic administration, there is good reason to assume that they are in some way related. The works particularly of Dearing and Heilman[4] and of Speare[5] seem to substantiate this assumption.

That localized necrotic processes also occur is borne out by our experience in one patient in whom chlortetracycline had been given for two weeks, two months prior to operation for the treatment of a diarrhea. Laparotomy exposed a sigmoid tumor, with a marked thickening of the bowel for about 26 cm. on its proximal side, with perforation and abscess. Subsequent examination of the removed specimen showed a necrosis of the mucosa in almost its entire length (fig. 1.).

McKittrick and Wheelock[4] apparently are opposed to the routine use of antibiotics both preoperatively and postoperatively. No one can disagree with them about the excessive use of antibiotics nor about the need for scrupulous care in doing open anastomoses, but we believe the distinction needs to be drawn between questionable preparation and the treatment of the almost inevitable

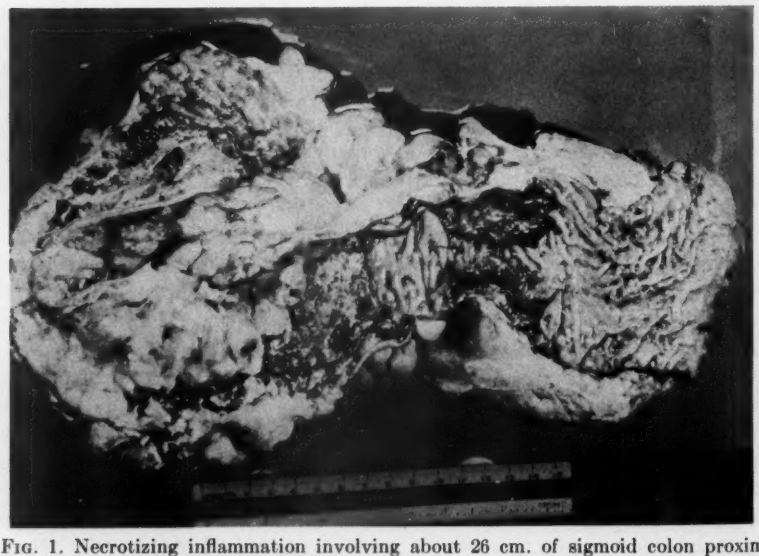

FIG. 1. Necrotizing inflammation involving about 26 cm. of sigmoid colon proximal to an obstructing adenocarcinoma. Adenocarcinoma and inflammatory process both were removed by Hartmann operation. The inflammatory process is believed related to 14 days oral chlortetracycline treatment for diarrhea two months before operative removal. The patient survived operation but died two months later of an unexplained recurrent pleural effusion.

soiling that accompanies the most fastidious technic. Our patients mostly have had left-sided lesions, requiring low pelvic anastomoses because of high inferior mesenteric ligation and, therefore, come within the purview of McKittrick's criteria for antibiotic help.

Other manifestations of bacterial imbalance of antibiotic origin may be cited. Gas infection of the abdominal wall is known to have followed the preoperative administration of neomycin for *five* days in 1 patient in the experience of Dr. C. R. Edwards.[2] Also, there have been several occasions in our experience in the past of *sterile* abscess or persistent sinus of the abdominal wall of questionable origin following a recognized bacteriostatic regime.

In a short series of 30 consecutive cases of colon resection with open end to end anastomoses since October 1951, done by us in several Baltimore hospitals, the routine use of preoperative anti-infective agents was omitted. It is not pretended that the series is long enough to permit any final conclusions, but when added to other similar series, some worthwhile statistics may eventuate. The average age of patients was 57 years. One patient was 34 years of age, 5 were 40 to 50, 14 were 51 to 60, 6 were 61 to 70, and 4 were 71 or over, the oldest being 79 years of age. One lesion was on the right side, the remainder were on the left side—mostly in the sigmoid colon—but none lower than 14 cm. from the anus. There were 11 males and 19 females. The complications consisted of 3 fecal fistulas (all of which closed spontaneously at a later date), 1 persistent rectovaginal fistula requiring operative closure, 1 case of cystitis, 1 pelvic abscess, and one case of pneumonia. In 11 patients there was some elevation in temperature above 100 degrees F. after the sixth postoperative day. In the case of the pelvic abscess, as a consequence of premature removal of a pelvic drain, fever continued for a period of 18 days. There were 2 deaths, in men 73 and 79 years of age respectively, each with advanced arteriosclerosis, in whom it is believed death might have been avoided if transverse colostomy had been done. The mortality rate in this short series conforms to that of our general experience before this regime was adopted and also to that of the Baltimore area. The average postoperative stay in the hospital was 18 days, the shortest stay being 12 days, the longest being 62 days. Several patients were permitted to convalesce in the hospital for longer periods than were actually necessary. In none of this series was there any phlebothrombosis or thromboembolic phenomenon.

Of decompression there is general uniformity of opinion. When there is either partial or complete obstruction, every effort is made to relieve the condition by palliative measures above and below the obstruction, failing which, in the case of colonic carcinoma, a colostomy may be necessary. In any case, removal of the tumor with re-establishment of bowel continuity is never done as a single-stage operation. If any form of long intestinal suction tube is used, its effect cannot be expected to extend beyond the ileocecal valve, and colonic distention still may remain a serious hazard even though the small bowel is in a collapsed state. The routine insertion of a Miller-Abbott or Cantor tube prior to any colon operation has much to be said for it. It may remove all distention from the small bowel and reduce the space which it occupies within the abdomen, but the meas-

FIG. 2. Roentgenogram of Cantor tube and mercury-filled bag impacted in esophagus. Strong traction under intravenous thiopental anesthesia, although hazardous, was successful in its dislodgement.

ure is not entirely free from risk. There are two complications, either of which may have serious portent. No matter how careful the introduction of the tube is done or its subsequent care, knotting of the tube may occur, making removal a very troublesome procedure. In one such case the interwoven mass of tube and bag was of such proportions that an anesthetic and some heroic pulling were necessary for its removal (fig. 2). A second complication, and one that may have dire effect, is necrosis of the intestinal wall, secondary to long-continued pressure on the mucous membrane by the mercury in the bag of a stationary tube. One such case has come within our experience, and even though an acute emergency was promptly recognized and bowel resection done, the patient died. One segment of that portion of the small intestine resected contained 9 perforations of 1 cm. or more in diameter (figs. 3 and 4). A third incident, of less consequence, was the entanglement of the advancing end of a Cantor tube in the ileocecal valve. Division of the tube permitted it to pass out through a terminal colostomy without ill effect. As a consequence of these disagreeable features, we have abandoned the routine use of any long intestinal suction tube and substituted the short Levin tube where necessary.

It has been our impression that failure at the site of anatsomosis is more frequently the result of ischemia than of any infective process, and in those patients in whom perforation or subsequent stricture have occurred, that peripheral vascular inadequacy has been to blame. Whenever any degree of arteriosclerosis is recognizable during operation, or if there has been sufficient manipulation of

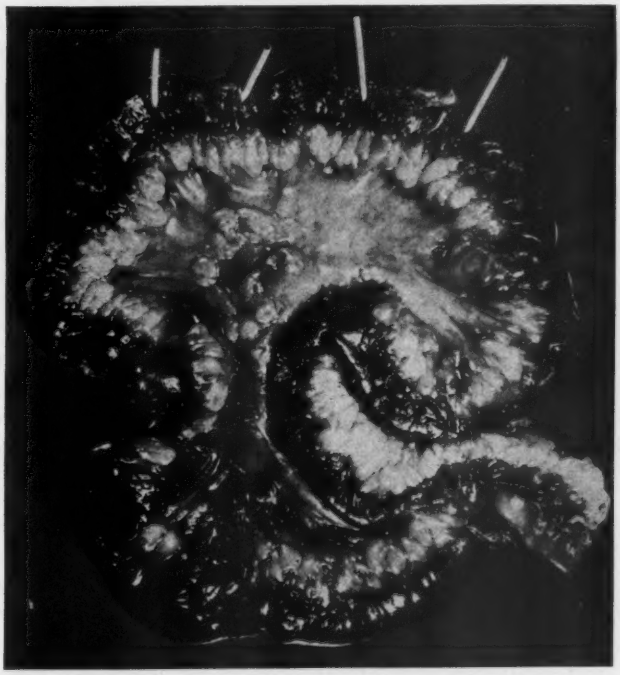

FIG. 3. A segment of ileum 140 cm. in length, containing 9 perforations, each at least 1 cm. in diameter, the result of prolonged pressure from the weight of mercury in the bag of an almost stationary Cantor tube. The specimen is that portion resected seven days after a palliative Hartmann operation for an advanced adenocarcinoma of the recto-sigmoid with liver metastasis, in a debilitated patient. The preoperative diagnosis (second operation) was small bowel obstruction, which accounts for the tube's nonremoval. The patient died 52 days after the original operation, from overwhelming sepsis.

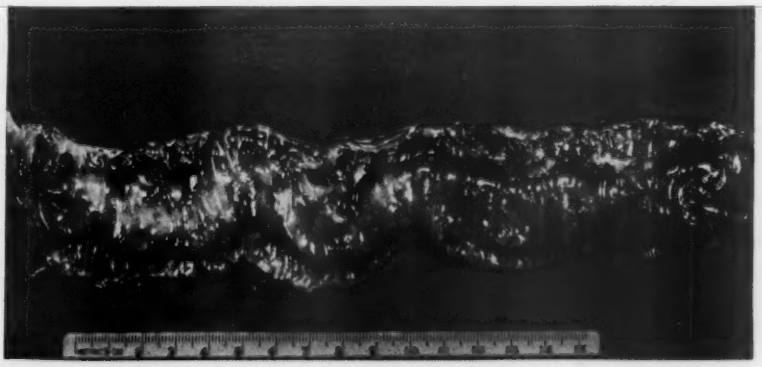

FIG. 4. Specimen the same as that in figure 3. Perforations of ileum clearly visible at upper border of specimen.

the mesocolon to produce possible arteriospasm, it is assumed that healing of the anastomosis will at least be delayed and perhaps completely jeopardized. In such circumstances, a defunctioning colostomy is indicated, especially if the union is to be at a low pelvic level. In elderly people it is practically impossible to determine whether the transected proximal end of the bowel will remain viable, especially if the marginal artery is to be the sole source of blood supply. In this case, proximal colostomy is almost mandatory at the time of resection. It appeared to be for this reason only that 2 cases of low anastomoses in senile patients ended fatally from disruption at the site of approximation. No amount of preoperative preparation can forestall such a state of affairs, and the only hope for prevention lies in a defunctioning colostomy.

Our bowel preparation consists, for the most part, of either castor oil or a strong saline cathartic given once or twice in the three days preceding operation, followed by enemas of plain warm water. In some patients, when there is obvious impaction above a low-lying carcinoma, oil retention enemas have been helpful, sometimes administered through a carefully introduced catheter beyond the point of obstruction.

Postoperatively, one of the broad spectrum antibiotics of the tetracycline group has been given intravenously in 0.5 Gm. doses at 12 hourly intervals for as many days as the temperature may be elevated beyond 100 degrees F., usually three days. When intestinal activity has been normally resumed and fever has continued, the same antibiotic has been given by mouth, usually in 250 mg. doses every 8 hours, for never more than 2 or 3 days. More recently the intramuscular route has been substituted so as to further avoid any possibility of gastrointestinal upset. No intraperitoneal antibiotics have been used, and their use is not anticipated.

## CONCLUSIONS

Because of the undesirable and sometimes dangerous consequences of preoperative administration of anti-infective agents, we have abandoned their use as a routine measure. In a small series of 30 patients in whom no preoperative bacteriostatics were used there has been no greater mortality rate and no greater morbidity than before their use was abandoned. For similar reasons, the introduction of the long intestinal suction tube as a routine preoperative decompressive measure has been discontinued. Wherever there is any doubt whatever concerning the viability of approximated ends in an intestinal anastomosis, especially in elderly people and those with arteriosclerosis, a defunctioning proximal transverse colostomy may be a life-saving measure.

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# OBSERVATIONS CONCERNING SOME INTERESTING LESIONS OF THE UPPER GASTROINTESTINAL TRACT

DANIEL J. PESSAGNO, M.D.

*Baltimore*

The cases herein presented are selected to demonstrate some of the problems which occasionally confront the surgeon. They are mainly examples of benign lesions of the stomach and duodenum. A case of regional enteritis isolated in the jejunum, and one of a gallstone impacted in the duodenal bulb with the roentgenographic impression of a possible primary duodenal tumor also are discussed.

Granted that such tumors are more common than is currently supposed, still they constitute but a small percentage of gastric and duodenal neoplasms. Such tumors represent approximately 0.5 per cent of all the tumors found in this region.

As Appleby[1] stated "leiomyomas are comparatively unknown in the experience of any one surgeon; however, a large number of cases are recorded". This statement applies to all benign tumors of the stomach and duodenum. Between 1939 and 1954, only 15 benign tumors of the stomach and 3 of the duodenum were encountered at the Mercy Hospital in Baltimore. There were 5 polyps, 6 leiomyomas, 2 neurofibromas, 1 fibroma and 1 inclusion cyst in the stomach, and 1 myoma, 1 myoangioma and 1 carcinoid in the duodenum.

Such lesions are not easily diagnosed. When one considers that they often simulate peptic ulcer with relief of symptoms on ulcer therapy, and with the confusion of roentgenographic findings, the difficulty in diagnosing these lesions is easily understood.

## STOMACH

### *Case Reports*

Case 1. A 79 year old, white woman, a nun, was admitted to the hospital on Nov. 19, 1953, because of sharp pain in the right scapular region radiating to the epigastrium and down the right arm.

Past history: she had an appendectomy and cholecystectomy 25 years ago, and fracture and pinning of her left hip 5 years ago. The complaint of pain had been present intermittently over the past two years but had been more severe and frequent in the past three months. There was one episode of vomiting of blood about three years prior to admission. The pain was described as of a sudden onset, lasting two to three minutes, but bearing no relation to activity or food intake. There was a loss of 10 pounds in weight in the past month.

Physical examination: There was a nodule in the right lobe of the thyroid gland. The blood pressure was 200/110. There were extrasystoles and a mitral systolic murmur. There was a small hernia through the right upper paramedian incision. A lipoma 4 cm. in diameter was found in the left lower quadrant of the abdominal wall.

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From the Department of Surgery, University of Maryland.

* Professor Clinical Surgery, University of Maryland; Attending Surgeon, Mercy Hospital, Baltimore.

Laboratory data: The urine was normal. The hemoglobin was 53 per cent (8 Gm.), red blood cells 3,300,000 per cu. mm., and white blood cell count normal. The platelet count, prothrombin time, sedimentation rate, cephalin flocculation test, cholesterol, and total protein were within normal limits. The alkaline phosphatase was 2.6 units. The anemia was normochromic-normocytic with achlorhydria. The stools showed a trace of occult blood on two occasions. The Kahn test was negative. The electrocardiograph showed a left ventricular strain. There were frequent auricular premature beats. A roentgenogram showed the heart moderately enlarged to the left; the lungs were clear. The common duct was faintly visualized by cholecystogram but no evidence of gallbladder was demonstrated on two separate occasions. A gastrointestinal roentgenogram showed a large oval mass which moved about freely in the proximal half of the stomach. It was the impression that this was a polypoid tumor or bezoar (fig. 1).

Hospital course: The patient received 3 pints of whole blood preoperatively without ill effect. On December 2, the abdomen was explored. A large, smooth, soft mass was present along the anterior wall of the stomach at the fundus. The stomach was entered and the tumor, which appeared well encapsulated and benign, was excised. It measured approximately 7 by 6 by 2 cm. On microscopic examination it proved to be a vascular leiomyoma, well-circumscribed.

The postoperative course was complicated only by a low grade cystitis. The patient was discharged on Dec. 16, 1953.

Case 2. A 52 year old, white male mechanic first was admitted to the hospital on April 16, 1953, at which time he complained of severe epigastric pain. He stated that for the past 25 years he had had spring and fall exacerbations of upper abdominal pain. The pain was relieved by eating, and usually occurred one to two hours before meals and about midnight. There had been no melena, hematemesis or jaundice. The past history was entirely negative. He had one brother who died of carcinoma of the stomach after years of ulcer symptoms.

Physical examination: The blood pressure was 150/90. Except for an occasional extra-

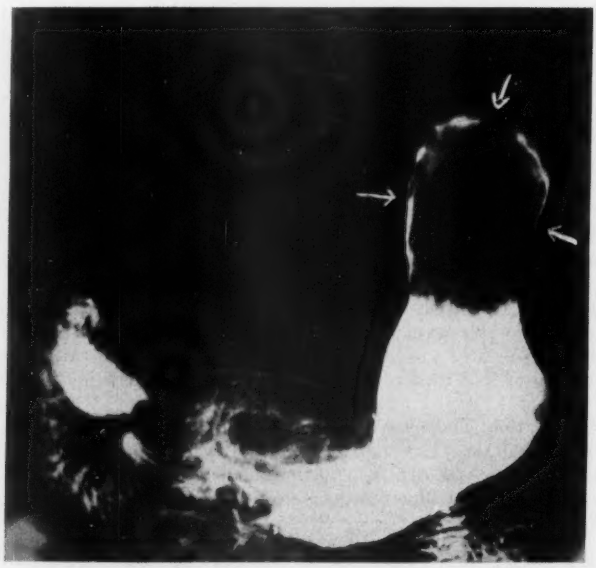

FIG. 1. An idea of the size of the leiomyoma is shown in the roentgenogram

systole and a mitral systolic murmur, believed to be arteriosclerotic in origin, there were no abnormal physical findings.

Laboratory data: These were all within normal limits.

Roentgenologic reports: A cholecystogram was normal. Gastrointestinal roentgenograms showed a markedly deformed duodenal bulb with an ulcer crater at its base point beyond the pylorus. There was no obstruction.

Hospital course: The patient was placed on a bland diet, Banthine and Gelusil with amelioration of symptoms. He was discharged on the tenth hospital day, pain free.

The second admission was on November 27. Despite faithful adherence to the above regimen, six weeks prior to admission he had severe epigastric pain, burning and occasional vomiting. He lost approximately 7 pounds in weight in six weeks. His symptoms were almost constant.

On physical examination, there was evidence of slight weight loss, mild epigastric tenderness and the previously noted mitral systolic murmur.

Laboratory data: The urine was normal. Urea was 62 mgm per cent, creatinine 1.5 mg per cent and the phenolsulphonthalein test showed 75 per cent excretion in two hours. The hemoglobin was 81 per cent and the white cell count was normal. The protein, alkaline phosphatase, chlorides, calcium, phosphorus, and amylase were normal. The electrocardiograph was normal.

A roentgenogram of the chest showed stringy infiltration in both apices due to tuberculosis. Comparison with film taken elsewhere in 1950 showed no change, so tuberculosis was regarded as quiescent. Roentgenogram again showed a large ulcer crater in the duodenum, this time with slight five hour retention.

Course: On Dec. 8, a subtotal gastric resection was done. In addition to the duodenal ulcer, there was a thickened, plaque-like structure along the greater curvature of the stomach proximal to the pylorus. The postoperative course was entirely uneventful and the patient was discharged on Dec. 30, 1953.

Pathologic report: (1) healing duodenal ulcer. (2) neurofibroma of stomach with erosion. The lesion was along the greater curvature about 6 cm. proximal to the pylorus (fig. 2).

Case 3. A 45 year old white woman, a housewife, was admitted to the hospital on Oct.

FIG. 2. The duodenal ulcer is seen on the left and the neurofibroma with ulceration is seen to the right.

4, 1954, with the complaints of weakness, fainting, and black tarry stools during the past week. The family history and past history are noncontributory. About one week previous to admission she felt weak and "*run down.*" Three days later when she did not improve she consulted her family physician who prescribed an alkali for some epigastric distress. The next day she felt weak and dizzy and soon thereafter she fainted. For approximately the entire week, she stated that she noted that her stools were black. Previous to the present illness, she had been perfectly well.

Physical examination: The blood pressure was 120/80 and the pulse 130. She was pale, mildly apprehensive, and restless. The abdomen was negative except for some slight tenderness in the epigastrium. The rest of the physical examination was negative.

Laboratory Tests: The hemoglobin was 45 per cent, the red cell count was 2,620,000 per cu. mm. and the white cell count was 10,700 per cu. mm. The urea was 45 mg per cent. The blood sugar, total proteins, cephalin flocculation test and bleeding and coagulation times were normal. The stools showed 4-plus blood.

Roentgenologic studies nine days after admission showed a rounded mass within the upper third of the stomach which appeared to be a leiomyoma. A carcinoma was not excluded. A blood clot was another rather remote possibility. The electrocardiographic tracing was normal except for tachycardia.

Hospital course: She was given 1500 cc. of whole blood in the first 36 hours and placed on an Andresen diet with no milk. In the nine days prior to operation she was given a total of 6500 cc. of blood. Six days after admission her hemoglobin was 75 per cent. Three days later the hemoglobin was 59 per cent although she received 1500 cc. of blood in the interval. Her urea remained elevated and it was obvious that she still was actively bleeding. On October 15 she was operated upon. A smooth circumscribed mass was found attached to the posterior wall of the stomach and was excised through the divided gastrocolic ligament. A sufficient amount of mucosa and serosa was removed with the mass which measured 5 cm. in diameter. Gross and frozen section examinations showed no evidence of malignancy.

Pathologic diagnosis: Neurofibroma of the stomach with erosion and ulceration on mucosal surface.

The postoperative course was entirely uneventful. She was discharged from the surgical service on Oct. 26, 1954.

## DISCUSSION

Three benign gastric lesions are presented: one leiomyoma and two neurofibromas. One of the latter presented itself with massive gastric hemorrhage and the other was found incidental to a resection for a duodenal ulcer. The predominant symptoms in the leiomyoma were pain, the history of vomiting of blood, and a marked secondary anemia.

*Leiomyoma.* These tumors give a bizarre and inconsistent clinical picture. Marshall[5] stated that they are common lesions while others consider them as rare. He reported 19 cases occurring in 12 years at the Lahey Clinic, 9 of which were found incidental to other surgery and 10 patients were operated upon with the preoperative diagnosis of gastric neoplasm. The preoperative diagnosis in our case was a polypoid tumor. They may remain silent for years with a history of periodic attacks of pain, tarry stools and hematemesis.

These tumors can present themselves as submucosal or subserosal growths or both. Appleby[1] reported six leiomyomas in 968 gastric resections, three of which were sarcomatous. Two of the latter patients had wedge excisions and at the time of his report were living 12 years and 7 years respectively. It should be

stated that some of these tumors incorrectly are classed as malignant because of degenerative rather than malignant changes and could explain the good results obtained in such cases. There are no symptoms or signs pathognomonic of these tumors. Again obstruction and hemorrhage, either hematemesis or melena, and the signs and symptoms of ulcer occur most frequently.

The treatment is surgical intervention. Resection is not a mandatory choice in these tumors. Local excision with an adequate cuff of mucosa and serosa suffices. They tend to remain encapsulated and if properly removed they do not recur.

*Neurofibroma.* Minnes and Geschickter[6] reported 931 benign tumors of the stomach of which 102 were neurofibromas.

In 1951, Palumbo[7] reported a case of ulcer and neurofibroma and stated that it had not been described previously in the literature. In his case, as in ours, the neurofibroma was not demonstrated by roentgenogram but was found incidental to a subtotal resection for an ulcer. The neurofibroma was found upon gross examination of the specimen. A duodenal ulcer also was demonstrated.

These tumors may occur in any portion of the stomach but they most frequently occur along the lesser curvature. They may grow submucosally or subserosally or both. They are pearly-gray, pinkish-yellow, or purplish-red if hemorrhagic. The tissue is firm but compressible and the cut surface is moist and glistening. It is estimated that approximately 10 per cent become malignant.

In 25 per cent of the cases there is gross hemorrhage or severe anemia. The so-called weeping type of bleeding may be the only symptom. These tumors have a tendency to ulcerate and cause pain, relieved by ulcer therapy. Fifty per cent of these tumors are diagnosed as malignant and 10 per cent as ulcers. Some of these patients are even treated as having pernicious anemia.

The treatment is surgical intervention even if the preoperative diagnosis is that of malignancy, and the prognosis is favorable even if malignant changes have occurred. Excision of the entire growth can result in a cure even in the malignant cases as they tend to remain encapsulated and metastases occur late.

In case 3 the course was typical of such lesions. The presenting sign is that of a massive hemorrhage with a history of previous good health.

Other benign tumors of the stomach which may be encountered are polyps (adenomas), neurilemmomas (schwannomas), carcinoids, fibromas, aberrant pancreatic tissue, lipomas, cystic tumors and vascular tumors.

## DUODENUM

Tumors of the duodenum, benign and malignant, are extremely rare as compared to such lesions in other parts of the gastrointestinal tract. The most common malignant tumor is carcinoma while the most common benign tumor is the single polyp. Other tumors found in the duodenum are lipomas, neurofibromas, angiomas, leiomyomas, cysts, aberrant pancreatic tissue and tumors of the lymphoma series. Many are asymptomatic and when clinical signs are manifest, they present themselves with obstruction or hemorrhage or they simu-

late an ulcer with epigastric distress, nausea, vomiting and anemia. Benign tumors of the duodenum rarely, if ever, become malignant.

Kellogg[4] reported 119 benign tumors of the intestine, five of which were in the duodenum. As stated, we have encountered but 3 cases in 15 years including a carcinoid which is extremely rare in this region.

### *Case Reports*

Case 4. A 73 year old white woman, a housewife, was admitted to the hospital on July 22, 1954, with the chief complaint of "aching and soreness in my stomach relieved by food".

History: Her present complaints had been present for approximately four months but had been much worse for the past three weeks. Her aching and soreness always were relieved by taking any kind of food. There had been no nausea or vomiting. Her bowels were regular without melena. Review of symptoms otherwise is negative. She had lost weight in the past four months.

Past history: Two years ago she had "*some polyps*" removed from her stomach. She also had had a cholecystectomy and an appendectomy.

Physical examination: The blood pressure was 220/110, temperature 98.5, and pulse 88. She was thin but appeared in no acute distress. There was a tender, nodular mass in the epigastrium to the left of the midline extending down to the umbilicus. The remainder of the physical examination was essentially negative except the scars of previous surgery.

Laboratory data: The urine was normal. Routine stool examinations showed traces of blood on July 23, 1954. The hemoglobin was 75 per cent (11.3 gm.), red blood cells 3,830,000 per cu. mm. and white blood cells 3,900 per cu. mm., with a normal differential. The blood chemistry was normal.

Roentgenologic data: The stomach showed no abnormalities except what is believed to be a huge mass of antral mucosa which had prolapsed through the pylorus and almost completely filled the duodenal bulb. One also had to consider that a polyp had prolapsed into the bulb. At the end of five hours the stomach was empty.

Hospital course: On July 29, she was given 500 cc. of whole blood and on July 30 she was operated upon. A large mass was felt in the duodenum and through an opening into the antrum this mass was found attached to the lesser curvature of the stomach by a long pedicle (fig. 3). This mass was excised with its pedicle and a wide area of stomach to which the pedicle was attached. The postoperative course was smooth and she was discharged on Aug. 11, 1954, the twelth postoperative day.

Pathologic diagnosis: Gastric polyp.

Case 5. A 49 year old white man, self-employed merchant, was admitted to the hospital on June 19, 1954, with the chief complaint of a burning sensation in the upper abdomen.

History: In December 1953, following a party, he was awakened from sleep with severe epigastric pain and nausea. He stated that since that time he had periodic intermittent epigastric burning relieved temporarily by sodium bicarbonate. After roentgenographic studies at another hospital, where a duodenal ulcer was discovered, he was placed on a diet, probanthine and antacids. Roentgenogram in May 1954, was said to show some evidence of healing, but recurring attacks of epigastric pain, bearing no definite food intake relationship, continued to occur. One week before admission, the pain became particularly severe and four days prior to admission he noticed black stools. There was no hematemesis. At the time of the last episode, the pain radiated to the left shoulder, arm, and elbow. He smoked one and one-half packages of cigarettes a day. Except for hay fever, the past history was negative. The family history showed only that one brother died of coronary thrombosis and the patient's mother died of a cerebral hemorrhage.

Physical examination: The blood pressure was 104/60, temperature 98 and pulse 80. Remainder of the physical examination, including abdomen and rectal examination was negative in all respects.

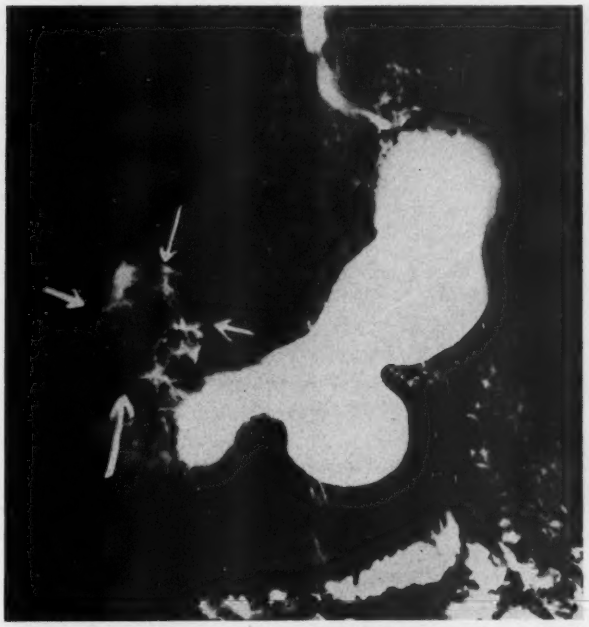

FIG. 3. Arrows outline the gastric polyp which had prolapsed into the duodenum

Laboratory: The hemoglobin was 65 per cent red blood cells (9.8 gm), rbc 3,500,000 per cu. mm., and white blood cells 19,200 per cu. mm. The blood sugar, urea, Kahn test, and urinalysis were within normal limits.

Roentgenologic data: Roentgenograms showed markedly deformed duodenal bulb, believed undoubtedly to be due to duodenal ulcer, although no crater was demonstrated. There was no obstruction.

Hospital course: The patient was placed on a 1,000 calorie Meulengracht diet, probanthine, and antispasmodics. He received two transfusions with resultant rise in hemoglobin to 95 per cent, (14 Gm.) and 5,050,000 red blood cells per cu mm. On June 25, 1954, he was operated upon. An ulcer was found which showed little inflammatory reaction, but the operator noted that palpation of the ulcer showed a "marble-sized mass" in the ulcer. Subtotal gastrectomy of a Hofmeister type was done. The post-operative course was uncomplicated.

Pathologic diagnosis: Carcinoid (duodenum) (fig. 4).

Case 6. A 69 year old white man, retired, was admitted to the hospital on May 3, 1954.

History: The family and past histories were entirely negative. He was admitted because of weakness and tarry stools which began seven days prior to admission. In the two years preceding admission, the patient had mild occasional epigastric pain relieved by ingestion of "*Tums*". For the month prior to admission, the pain had occurred regularly about one hour after meals. Before this, there was no association of pain with food intake. There was no history of hematemesis, nausea or vomiting.

Physical examination: The blood pressure was 215/80 and pulse 116. He appeared pale. Eyes showed bilateral mature cataracts. There was a widespread systolic mitral murmur heard over the entire precordium. The abdomen was entirely negative.

Laboratory data: The urinalysis showed 4 plus sugar; stools were positive for blood in every specimen from May 6 to 12. The initial hemoglobin was 4.2 Gm. and the red blood

FIG. 4. Microscopic picture of duodenal carcinoid (×1000)

cells were 1,440,000 per cu. mm. and white blood cells were 6,850 per cu. mm. The urea was 40 mg per cent. Bleeding and coagulation time and thrombocyte count were normal. On May 7, the blood sugar was 260 mg per cent. The electrocardiograph was suspicious of old posterior myocardial infarction.

Roentgenologic data: The esophagus, stomach and duodenal bulb were normal. There was a polypoid filling defect in the right transverse portion of the duodenum. This was thought to be an adenoma or primary malignancy. Chest roentgenograms showed a left ventricular hypertrophy and the lungs were clear.

Hospital course: After the blood count was stabilized with transfusions, operation was done May 12. The duodenum was mobilized and a tumor was found in the third portion. About ⅔ of the tumor was in the lumen of the duodenum, about ⅓ was extra-lumenal. The tumor was excised and the defect in the duodenum was sutured transversely. The tumor was oval, 5 by 3.5 cm. in size, lobulated and circumscribed. Following operation the hyperglycemia was readily controlled by diet and insulin. He was discharged on May 25, 1954.

Pathologic examination proved the tumor to be a myoangioma of the duodenum (fig. 5).

FIG. 5. Myoangioma of the duodenum with ulceration on the mucosal surface

FIG. 6. The gallstone is demonstrated plainly impacted in the duodenal bulb

Case 7. A 66 year old white woman, a housewife, was admitted to the hospital on June 13, 1953, with chief complaints of pain, nausea, and vomiting of two days duration. The pain was not severe; was epigastric and radiated retrosternally. The day prior to admission she began to vomit with relief of pain.

Physical examination: The patient was in no acute distress. She appeared to have lost considerable weight. Her abdomen showed a slight degree of rigidity but no tenderness. There was a firm mass about 5 cm. to 7 cm. in diameter which was palpable in the right upper quadrant near the midline. Liver, spleen and kidneys were not palpable.

Laboratory Data: All tests were within normal limits.

Roentgenologic data: A roentgenogram showed an almost square fixed mass present within the duodenal bulb. It was the impression that this might represent a gallstone which had perforated into the bulb. Other possibilities were primary duodenal tumor, either benign or malignant, or aberrant pancreatic tissue.

Hospital course: At operation on June 17, the gallbladder was found thickened and contracted, and impacted in the first portion of the duodenum was a stone about the size of an English walnut (fig. 6). Another stone could be felt posterior to this but it could not be determined where the gallbladder ended and the duodenum began and in the process of separating them, a cholecystoduodenal fistula was demonstrated. The stone in the duodenum was removed and the opening appropriately repaired. The gallbladder which contained one stone then was removed. Her postoperative course was smooth and she left the hospital on July 3, 1954, the sixteenth postoperative day.

Pathologic diagnosis: Chronic cholecystitis with a superimposed acute inflammation and necrosis. Cholelithiasis.

## DISCUSSION

The patient in case 4 (fig. 3) appeared to have a polyp of the duodenum although in reality it was a polyp of the gastric antrum. Gastric polyps frequently

occur in the pyloric antrum where peristaltic action forces them through the sphincter, elongating the pedicle with ulceration, hemorrhage and obstruction. Such tumors are removed by a simple operation that preserves the sphincter. These cases are in reality adenomata, but always are referred to as polyps. They are nonmalignant, usually pedunculated tumors although they may be sessile.

Carcinoids frequently are malignant when they arise in the intestinal tract while in the appendix they almost are invariably nonmalignant. They have the same gross and microscopic appearance in both regions and the difference in behavior cannot be explained. The malignant type metastasizes to the liver and is associated with severe toxemia and cachexia. They are resistant to radiation. They usually are discovered at operation for some other lesion. In the case presented, the preoperative diagnosis was duodenal ulcer. In view of the rarity of this lesion, the pathologic report as dictated by our pathologist, Dr. C. Gardner Warner, is given.

"The tumor showed erosion and necrosis on the surface. Brunner's glands are present in the vicinity denoting a duodenal location. Beneath the muscularis mucosa is a growth arranged in a lobulated and alveolated pattern. The cell type is columnar and arranged in compact tubular and glandular structures. The cell elements are hypochromatic, but orderly, and appear foreign to the Brunner's glands or the overlying mucosa. The growth penetrates deeply, displacing the muscle. It is sharply limited about the periphery. Its resemblance to carcinoma has given this the name of carcinoid. These tumors usually are benign but metastasizing malignant counterparts are seen." Pathologic diagnosis: Carcinoid tumor (duodenum).

The angiomyoma is of interest, first, because of its rarity and, second, because it simulated a peptic ulcer and was relieved by ulcer therapy. Hemorrhage of the weeping type was the outstanding clinical picture. The patient was admitted with an initial hemoglobin of 4.2 Gm. and a red blood cell count of 1,440,000 per cu. mm. The tumor in the third portion of the duodenum grew both subserosally and submucosally. It was removed by simple excision.

Pathology: Dr. C. Gardner Warner reported, "The mucosa is highly colored and intact except for a 2 mm. area of ulceration. On section a lobulated, circumscribed, fleshy hemorrhagic mass makes up practically the entire specimen. Several cystic hemorrhagic blebs are present in the tumor. The tumor tissue resembles immature villous placenta. Microscopically many large cavernous vascular spaces are seen. The overlying mucosa is not involved in the tumor. The growth seems to have arisen in the muscular wall. Bundles of muscle and fibrous tissue in orderly arrangement are more prominent in the periphery of the tumor than in the center. Most of the center is made up of giant vascular spaces. This appears as a benign process and on the basis of its cellular makeup must be considered a mixed type of tumor." Pathologic diagnosis: Myoangioma of the duodenum.

Case 7 (fig. 6) is presented chiefly because preoperatively it simulated an ulcer with obstruction and the roentgenogram suggested a gallstone which had perforated the duodenal bulb, or a primary duodenal tumor. With respect to such

cases it is interesting to report an experience with a 70 year old white woman who was operated upon for a complete obstruction of the midileum by a gallstone impacted in this region. She did very well postoperatively. Several months later she had a similar episode. A preoperative roentgenogram at this time disclosed another stone impacted in the ileum with obstruction, and a stone also was seen in the third portion of her duodenum. This case is mentioned to advise that when a patient is seen with a gallstone ileus, it is imperative that roentgenograms be made and operative search be done to rule out the presence of other stones that might cause obstruction later on.

### REGIONAL ENTERITIS (JEJUNUM)

Benign hyperplastic lesions of the intestinal tract described generally as nonspecific granulomatous inflammations have been recognized and so reported in the literature for years, but it remained for Crohn, Ginzburg, and Oppenheimer[2] to popularize the lesion. However, they left the impression that it was confined to the terminal ileum. They further stated that it was both a clinical and a pathologic entity. It is now well known that identical pathologic lesions can appear anywhere in the intestinal tract including the colon. Terminal ileitis therefore cannot be considered a pathologic entity.

Regional enteritis is divided into four stages: The acute phase, the stage of active enteritis, the obstructive stage, and last the stage of fistula formation. In 1937, we reported a case in which all four stages were observed. It is worth recording that no case has been reported in which a fistula has perforated into the peritoneal cavity. They occur between loops of intestine and also rupture externally through the abdominal wall. No satisfactory explanation has as yet been offered regarding the etiology of the lesion. Crohn[2] emphasized the chronicity of the lesion, but the condition can run a fairly acute course. Surgery will interrupt the disease at any stage.

In the acute stage the condition rarely is diagnosed. In the chronic forms the clinical picture of mild obstruction with cramp-like abdominal pain, especially after meals, associated with vomiting, malaise, anemia, and mild fever is seen.

Case 8. A 47 year old white man, a button-hole maker, was admitted to the hospital on June 13, 1954.

History: Past and family histories were noncontributory. For the past year, the patient had noted intermittent fever at about weekly intervals. He also had occasional episodes of epigastric pain associated with vomiting. In addition, for the past five years he had joint pains involving at various times his neck, shoulders, wrists, knee and elbow joints.

Physical examination: This was negative in all respects. The blood pressure was 120/80.

Laboratory data: These findings were with normal limits except evidence of slight anemia.

Roentgenologic data: The entire duodenum was hugely dilated down to its midtransverse portion. Impression: Obstruction of the transverse duodenal limb. Possible causes suggested were: congenital adhesions, annular pancreas or primary duodenal carcinoma.

Hospital course: On June 21, 1954, the abdomen was explored. The first, second, and third portions of the duodenum were tremendously dilated. The jejunum, beginning about 6 inches from the duodenal junction, was thickened, inflamed and had all the gross appearance of regional enteritis. The involved jejunum was resected and an end to end anastomosis was

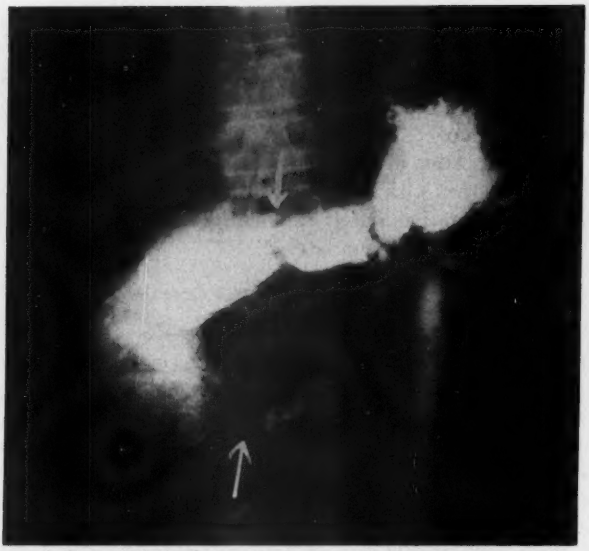

FIG. 7. A much distended duodenum is shown with the upper arrow denoting pylorus and the lower arrow denoting the site of obstruction.

done. The postoperative course was completely uneventful and the patient was discharged on the eighteenth hospital day.

Pathologic report: Regional enteritis (fig. 7).

## DISCUSSION

In the case herein reported, the roentgenogram showed the duodenum hugely dilated and the impression was that of obstruction. The jejunitis started about 10 cm. from the ligament of Treitz.

Pathologically the lesion is described as a necrotizing and cicatrizing inflammation of all of the coats of the intestine, frequently leading to stenosis and fistula formation. In the case here reported, the involved segment of jejunum was red, edematous and thick with sharply demarcated borders. The mesentery was brawny and 2.5 cm. in thickness. Inflammatory adhesions accounted for the obstruction.

In 1939, Shapiro,[8] in a review of the literature, reported 16 of 462 cases of regional enteritis that involved the jejunum alone, an incidence of 3.4 per cent. Brown and Donald[3] recorded 5 of 178 cases with jejunal involvement only at the Mayo Clinic from 1922 to 1940, an incidence of 3 per cent.

In a consideration of the treatment, it would seem that complete resection of the involved intestine is essential to recovery. Yet it is well to bear in mind that many patients recover spontaneously or are cured by operations less than resection, such as exclusion procedures. Two stage procedures are favored by some. Others advise anastomosis with exclusion and later resection if symptoms persist.

The treatment as a whole is surgical intervention. Medical management cannot as yet be given serious consideration, chiefly because of the unknown etiology of the disease, although recent reports certify to the effectiveness of ACTH in its treatment.

In the surgical management of the acute cases, after the diagnosis of enteritis is established and in view of the fact that these patients are not properly prepared for surgery, exploration alone is advisable. If the lesion is limited to the terminal ileum, appendectomy is a disputed point because of the possibility of a resultant fistula. In 5 such patients in our experience, an appendectomy was done with no untoward results. One of these cases is worth recording. It is that of a young girl who was operated upon with the preoperative diagnosis of acute appendicitis. At operation a typical terminal ileitis was found. An appendectomy alone was done. Postoperatively she was placed on an intensive course of penicillin therapy. She remained asymptomatic for two years after which time she began having cramp-like abdominal pains with occasional nausea and vomiting and constipation. She was again operated upon and we were firm in our belief that her terminal ileitis still was present. Surprisingly no remaining evidence of her ileitis was found. The terminal ileum appeared perfectly normal. Adhesions, which were responsible for her complaints, were corrected and she now is perfectly well. Penicillin therapy—and cures from it are reported—could have been responsible for the eradication of the disease in this case or it could have been a case of spontaneous recovery. If fistulas are present, resection is the procedure of choice.

SUMMARY

Some interesting and relatively rare benign lesions of the upper gastrointestinal tract are presented with comments and observations concerning them.

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# CONCOMITANCE OF ACUTE APPENDICITIS AND ACUTE CHOLECYSTITIS*

D. L. Reimann, M.D., H. G. Reeves, M.D.

*Baltimore*

Inflammatory lesions of the appendix may be a local manifestation of an infectious disease widespread in the alimentary tract, a local manifestation of a generalized infectious disease, or a disease resulting from abnormal processes limited to the appendix.

Appendicitis is commonly considered to be the result of local factors and occasionally the result of generalized infectious maladies. The latter thesis is supported by the occurrence of appendicitis in measles, chicken pox and upper respiratory infections.[8] The appearance of appendicitis in a disease which is widespread in the gastrointestinal canal may be exemplified in typhoid fever and regional enteritis. A less patent relationship exists between acute cholecystitis and appendicitis. Whether the inflamed gallbladder and appendix share the effects of a generalized disease or are alone in their relationship is conjectural but, in either event, the coexistence of acute appendicitis and acute cholecystitis is not a coincidence.

The coexistence of appendicitis and cholecystitis has been explained by Draper[6] on the basis of infectious agents being exchanged between the appendix and gallbladder via the portal vein and lymphatic system. Rosenow[11] has spoken of simultaneous foci of infection in the gallbladder, appendix, stomach and pancreas resulting from hematogenous spread of infection from various primary foci. Carter[5] has proposed a reflex relationship between the two organs which may predispose to simultaneous inflammation. Whatever the reason for cholecystic-appendiceal disease, numerous reports have appeared to testify to its occurrence.[1, 2, 3, 7, 9, 10]

In 41 patients who had proved cases of acute cholecystitis at the University Hospital, and who had cholecystectomies and appendectomies during the past 30 years, almost 10 per cent had acute appendicitis. The incidence of acute appendicitis in patients treated for chronic cholecystitis was slightly over 3 per cent. In a control group of patients who had uterine fibromyomas removed with the appendix, the incidence of acute appendicitis was approximately 3 per cent (table 1).

The incidence of simultaneous acute cholecystitis and acute appendicitis in the present series prompts a greater awareness of the possibility of interrelated gallbladder and appendiceal infections. Thus, one is supplied with a direct explanation of overlapping symptoms and continued symptoms after removal of either of the two organs. Taniguchi and Stratton,[12] reporting a 12.1 per cent incidence

* From the Departments of Pathology and Surgery, University of Maryland School of Medicine and the University Hospital, Baltimore, Maryland.

Aided by a grant from the Sydney M. Cone Research Fund.

TABLE 1

*Incidence of acute appendicitis in patients treated for acute and chronic cholecystitis and fibromyomata uteri*

| Primary Diagnosis | Secondary Diagnosis | | |
|---|---|---|---|
| | Acute Appendicitis* | | |
| Acute Cholecystitis (41 cases) | Focal | 4 cases | (9.7%) |
| | Diffuse | 4 | (9.7%) |
| | Peri | 2 | (4.9%) |
| Chronic Cholecystitis (60 cases) | Focal | 2 | (3.3%) |
| | Diffuse | 2 | (3.3%) |
| | Peri | 0 | (0%) |
| Fibromyomata Uteri (60 cases) | Focal | 3 | (5%) |
| | Diffuse | 2 | (3.3%) |
| | Peri | 5 | (8.3%) |

* Diagnosis of acute diffuse appendicitis was based upon diffuse polymorphonuclear infiltration, vascular phenomena, and suppuration.

of acute appendicitis in patients with gallbladder disease, have recommended the removal of the appendix, if accessible, in patients having cholecystectomies. Prudence requires, unless definitely contraindicated, at least the inspection of both the gallbladder and appendix in patients operated upon for acute cholecystitis or acute appendicitis where the symptoms seem to be mixed.

## SUMMARY

In this series, acute appendicitis occurred in 9.7 per cent of the patients who had proved cases of acute cholecystitis.

The incidence of acute appendicitis in chronic cholecystitis and in the presence of uterine fibromyomas was approximately 3 per cent.

Acute cholecystitis and acute appendicitis occur as allied diseases and not merely as a coincidence.

Acknowledgment:—The authors are indebted to Mrs. Florence R. Kirk for her searching of the foreign literature.

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# DISRUPTION OF ABDOMINAL WOUNDS

HARRY C. HULL, M.D., JOHN R. HANKINS, M.D.

*Baltimore*

The purpose of this report is to review the incidence and mortality rate of wound disruption at the University Hospital for a five year period and to tabulate some of the factors concerned with this unfortunate complication of abdominal surgery.

Disruption of abdominal wounds (dehiscence, burst abdomen, evisceration and postoperative disruption of abdominal wounds) is defined as separation of any portion of the incision which includes the fascial sheath or deeper layers., It is considered complete if viscera were extruded or incomplete if the peritoneum remained intact.

## INCIDENCE

The material for analysis comprised 4177 consecutive abdominal operations at the University Hospital covering the five year period 1948 to 1952. During this period, the McBurney incision was used in an additional 1899 patients without any disruption so the McBurney approach was excluded from this study. Of the 4177 laparotomies, there were 80 patients who had disruption, 68 complete and 12 incomplete; an incidence of 1.9 per cent. Of the 80 disruptions, there were 20 patients who died, a mortality rate of 25 per cent.

## AGE, SEX, RACE

The age range was from 22 to 84 years, an average of 54.9 years. There were 12 patients under 40 years of age, all of whom were Negroes. Of this group, 4 were operated upon for uterine fibroids, 4 for abdominal stab or gunshot wounds, 3 for peptic ulcers and 1 for intestinal obstruction. This average of 54.9 years coincides with the figure of Wolff[4] who reported the majority of 45 disruptions occurring between the ages of 50 and 54 years. In the aged, factors such as protein imbalance, Vitamin C tissue content, general nutritional state, healing rate of tissue, bronchitis and the presence of cancer have been considered by many authors in discussions of this subject. It is believed no one factor can be held responsible, for it has been observed that in many older, poor-risk patients with multiple deficiencies, operated upon for acute abdominal catastrophies, where disruption would be no surprise, it does not occur. Again the reverse may happen, i.e., a younger, good-risk patient, who has been subjected to good, careful surgery, who has no deficiencies, may disrupt as a complete surprise. That dehiscence occurs, however, with greater frequency in the upper age groups generally is conceded and is the case in this series. Table I shows that 67.5 per cent occurred after 50 years.

From the Department of Surgery, University of Maryland School of Medicine, Baltimore, Maryland.

TABLE 1

*Age, incidence & mortality rate*

| Years | Disruptions | | Died | |
|---|---|---|---|---|
| 20–29 | 5 | | | |
| 30–39 | 6 | | | |
| 40–49 | 15 | | 2 | |
| 50–59 | 20 | 67.5% | 5 | 90% |
| 60–69 | 21 | | 8 | |
| 70–79 | 11 | | 4 | |
| 80–89 | 2 | | 1 | |
| Totals | 80 | | 20 | |

While it does not seem reasonable that sex should be a factor in disruption, most authors report a higher ratio in men. In these 80 cases, the complication was over four times as frequent in men, 66 occurring in the male and 14 in the female. Tweedie[3] reported the incidence in males over females as 6.7 to 1. It is believed that the location of the incision and type of surgery account for the difference rather than sex. Disruption occurred more frequently in operative procedures in the upper abdomen and colonic procedures in the lower abdomen than for gynecologic operations alone. Thus in the material presented, 4177 patients, there were 5 disruptions in 1810 gynecologic operations as compared to 75 disruptions in the remaining 2367 celiotomies, regardless of sex.

The economic status of the patient was not notable as regards disruption since 41 were patients admitted to the free service and 39 to the private service. Of the patients with disruptions, 58 were white and 22 were Negroes.

## INCISION

Most surgeons have an individual preference for incisions and some believe strongly about their choice. Records will show, however, that none is immune

TABLE II

*Location and type of incision*

| Incision | Disruptions | | Per Cent |
|---|---|---|---|
| Upper | | 54 | 67.5 |
| Rectus | 38 | | |
| Paramedian | 12 | | |
| Transverse | 4 | | |
| Lower | | 22 | 27.5 |
| Rectus | 9 | | |
| Paramedian | 2 | | |
| Midline | 11 | | |
| Midabdominal | | 4 | 5.0 |
| Paramedian | 1 | | |
| Rectus | 3 | | |
| Totals | 80 | 80 | 100.0 |

from disruption. Wolff[4] emphasized the fallacy of reporting that a certain type of incision was more apt to disrupt than another without computing the rate of disruption of the various types. This was ably done by that author and is not repeated in this report. Table II simply records the location and type of incision used without attempting to label any type of incision as being more prone to disrupt. The rate of disruption as to location (upper or lower approach) was, however, tabulated in the total.

In 3185 patients where the incisions were definitely classified as upper or lower, the incidence of disruption was approximately six times greater in the upper abdomen. In 1893 lower incisions, there were 10 disruptions as compared with 39 instances in 1292 upper incisions.

It is accepted generally that no single factor is responsible for dehiscence. The location, type and repair of the incision, although of prime importance, are not alone always responsible for the complication.

## SUTURES

Over the years, various suture materials have indefinite periods of popularity. Some surgeons still erroneously believe that the type of suture is the answer to disruption. Table III illustrates that the type of suture per se has nothing to do with the prevention of disruption. The analysis of these 80 cases, without the type of sutures used in the total of 4177 patients, admittedly is not too informative. Wolff,[4] however, reported this rate as 1.3 per cent with catgut (594 cases), 3.1 per cent with nonabsorbable sutures (907 cases) and 3.5 per cent where both were used (57 cases). In 113 disruptions reported by Tweedie,[3] the incidence was greater with wire than with catgut.

It is believed that more stress should be placed on technic and courtesy to tissue than to the type of *string* employed. Avoidance of careless big bites in the peritoneum, of mass ligation of tissues, of too tightly tied sutures, of inaccurate hemostasis and of fighting wound closure with unsatisfactory anesthesia all are important. However, personal equation, fatigue after long procedures, attempts at speed, at times cause individuals to forget or ignore these teachings.

In these reported cases of disruption, catgut was the peritoneal suture used in all patients. With the possible exception of catgut closures and fine silk used throughout the layers in infants, the suture materials used at the University Hospital are invariably mixed—i.e., absorbable and nonabsorbable.

Retention sutures were used in 7 patients. Wolff[4] reports an incidence of 3.2

TABLE III

*Suture material used*

| Suture | Disruptions | Per Cent |
|---|---|---|
| Catgut | 26 | 32.5 |
| Steel Wire | 24 | 30.0 |
| Silk | 30 | 37.5 |
| Totals | 80 | 100.0 |

per cent dehiscence in 280 incisions when such sutures were used. Marsh and Coxe[2] reported no disruptions in 500 consecutive *uncomplicated* incisions, in which through and through sutures plus layer closure were used. It is not the purpose to discuss the pros and cons of this type of reinforcement. Retention sutures are not in common usage at the University Hospital. It may be stated, however, that although retention sutures will not prevent disruption; if inserted properly and not removed too early, they will prevent massive evisceration.

### PROCEDURES

Operations for gastric and duodenal lesions numbered 519 of which 25 patients, or 4.8 per cent, had disruption. One of these 25 patients had retention sutures used in closure of the incision. This incidence is very high and might be of interest to those surgeons who routinely employ retention sutures in incisional closure following gastric resections. Operations upon the biliary tract numbered 773 of which 14 patients or 1.8 per cent eviscerated. Laparotomy for gynecologic disorders done in 1810 patients were complicated by 5 disruptions or 0.26 per cent. In 83 abdominoperineal resections, in which the colostomy was made in the operative wound, there were 5 disruptions or 6.0 per cent. Tweedie[3] reported the highest incidence of dehiscence in operations upon the stomach and colon.

Undoubtedly, the magnitude and cleanliness of the procedure, the location of the incision, the wound closure, the metabolic condition of the patient, as well as the anesthesia, all influence wound healing, but cannot singly be held responsible for the complication.

### AMBULATION

In 63 of the patients, ambulation was begun on an average of 3.4 days after operation. In the remaining 17 patients, ambulation was not begun at all from the time of surgery until the time of recognized wound disruption. Ambulation in 2 of the patients was recorded as the precipitating factor. Dehiscence was noticed "on getting out of bed in the a.m." in 1 patient and occurred "on climbing back into bed" in the other.

Since early ambulation generally is practiced by all surgeons at the University Hospital, it is believed that it is not an outstanding contributory factor toward dehiscence.

TABLE IV

*Structures operated upon*

| | Disruption | Per Cent |
|---|---|---|
| Stomach | 25 | 31.25 |
| Biliary tract | 14 | 17.50 |
| Colon | 12 | 15.00 |
| Small Intestine | 11 | 13.75 |
| Uterus | 5 | 6.25 |
| Laparotomy—miscellaneous | 13 | 16.25 |
| Totals | 80 | 100.00 |

### POSTOPERATIVE COMPLICATIONS

Distention recorded as moderate to severe occurred in 32 of the 80 patients. Preoperatively 49 of the 80 had stomach or intestinal tubes passed. Retching, vomiting or hiccoughs occurred in 30 in the first few days postoperatively. Coughing, moderate to severe, occurred in 46 patients. Important to note is that distention, vomiting or coughing, occurring singly or together, were present in 76 of the 80 patients. Further, in 21 patients, coughing was cited as the direct or final cause of the wound disruption. Despite the presence of these three complications, they cannot serve as prognostic criteria for later wound disruption, but simply as strong contributory factors. Many surgeons have seen all three occur in a postoperative patient who, without abdominal support with binder, without retention sutures, without instructions as to how to lessen abdominal tension while coughing, finally convalesces without wound damage or subsequent incisional hernia. However, since these three factors of distention, coughing and vomiting seem to be such a common denominator in wound disruption, it would seem to be of particular importance to recognize and rectify the conditions as early as possible.

Treatment of secondary anemia was unsatisfactory in the immediate preoperative or postoperative period in 11 of the 80 patients in whom the hemoglobin was below 10 Gm. or 75 per cent. Blood proteins were below 6.5 Gm. in 25 patients during the immediate preoperative or postoperative period. It was noted that in 2 patients with low or borderline hemoglobin determinations, an attempt was made to correct the deficiency while doing elective surgery. This is, of course, a procedure to be condemned unless emergency dictates its necessity. Examination of the wounds in the 80 patients with disruption showed gross evidence of infection in 14 and hematomata in 4. The remaining 62 wounds were reported as clean. Incisional drains were used in 12 wounds at the time of the original operation. Antibiotics were given postoperatively to 66 of the patients, either for prophylactic reasons or to treat specific infections.

### TIME OF RECOGNITION

The day of the appearance of the telltale serous drainage on the dressing is the time that dehiscence usually is recognized. However, the day of recognition may be days after the process has begun. Due to cough, distention, vomiting or retching, a dissecting wedge of omentum may have been forced through a good peritoneal closure in the first few hours after operation. During the first four to five days of wound weakness, aided by recurrent bouts of retching or coughing, the wedge may further mushroom its way into the fresh wound. Then, followed by fluid accumulations, pressure necrosis, with or without infection, fascial dissolution around the suture and fascial separation, the subcutaneous fat and skin alone are left to contain the viscera. Pressure then separates these layers, heralded by the typical red fluid. When this is followed by omentum or intestine, the process is complete. In some patients, if the skin sutures have not been removed, the fluid may be absorbed, the omentum adhere, and instead of evisceration, an incisional hernia may be the result.

In these days of early ambulation, removal of skin sutures in 5 to 7 days after operation and early discharge from the hospital, disruption can occur at home. Such an instance is recorded briefly:

61675 C. M., a Negro man aged 40, was admitted to the University Hospital on Feb. 4, 1954 with a stab wound in the upper right quadrant of the abdomen. A small laceration of the liver was sutured through an upper right rectus incision. The operative wound was closed without drainage, using catgut in the peritoneum, no. 32G steel wire in the fascia and interrupted silk sutures in the skin. Convalescence was complicated by mild abdominal distention for two days following the operation. The skin sutures were removed eight days after operation and the patient was discharged. The following day, while at home, the patient had a complete wound disruption. Alone, he returned to the hospital, was readmitted, the wound was repaired, and he recovered.

When dehiscence is incomplete, a combination of factors also may be responsible for fascial separation under an intact skin. Hematoma, infection, catgut sensitivity, distention, coughing, or vomiting all may play a role. One or more of these factors may have been active days before a blister appears in a formerly clean looking suture line. When the blister opens, or is opened by the doctor, and a quantity of serous drainage follows, only then may the surgeon be aware of what has been transpiring during the days of what was assured to be a normal convalescence.

In the 80 cases reported, disruption was recognized from the extremes of 1 to 18 days, an average of 8.02 days. As shown in table V, 77.5 per cent occurred after 6 days.

## REPAIR

Disruption is a distressing event to both patient and doctor. When discovered, every effort should be made to lessen the mental shock to the patient who may

TABLE V

*Day of recognition of disruption*

| Day | Disruptions | |
|---|---|---|
| 1 | 1 | |
| 2 | 0 | |
| 3 | 3 | |
| 4 | 5 | |
| 5 | 3 | |
| 6 | 6 | |
| 7 | 15 | |
| 8 | 14 | |
| 9 | 7 | |
| 10 | 10 | |
| 11 | 8 | 77.5% |
| 12 | 3 | |
| 13 | 2 | |
| 14 | 1 | |
| 15 or over | 2 | |
| Total | 80 | |

not be aware of the gravity of the complication. Many of these patients are not ill when the dehiscence occurs and it is a challenge to the tact of the physician to cause as little alarm to the patient and family as possible.

When disruption is recognized at the bedside, sterile dressings are applied, reinforced by generous strips of adhesive and an abdominal binder. Concurrently an analgesic should be administered, preferably hypodermically. Shock, if present, is treated. If the patient has just eaten, it is believed that repair should, if possible, be postponed five to six hours until the stomach is empty. A tube should be passed into the stomach when the patient arrives in the operating room, or before, if it is thought that further evisceration can be controlled. If the patient has not eaten, repair can be effected within the hour.

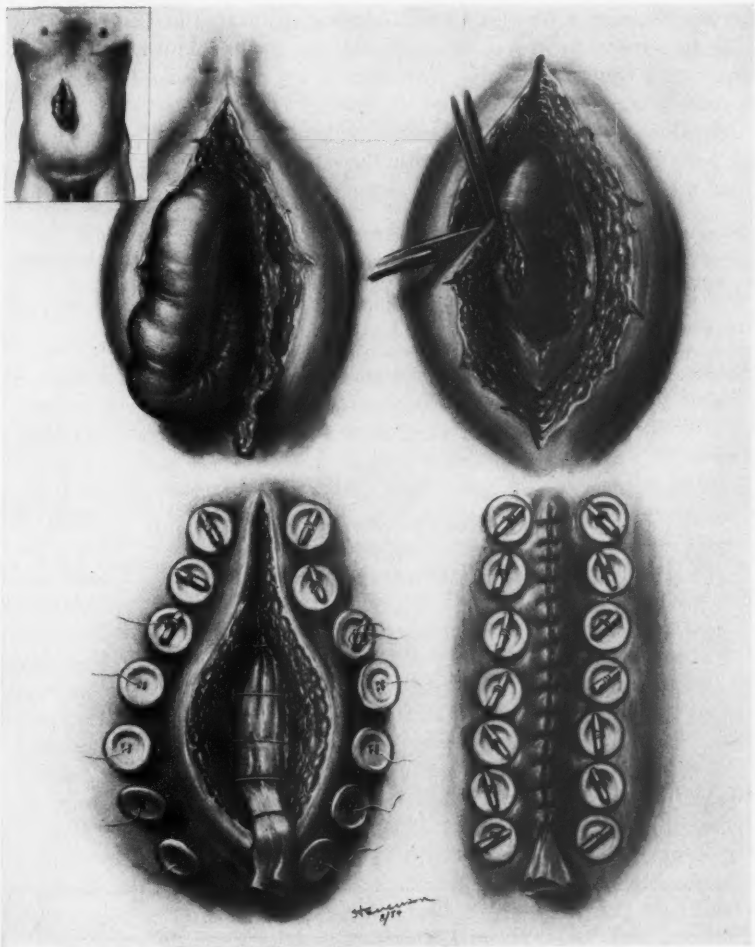

FIG. 1. Technic of repair used in the majority of cases reported

After the patient is anesthetized the dressings are removed, the protruded viscera are covered with sterile, moist gauze and the surrounding skin area is prepared surgically. The protruded viscera then are gently cleansed with warm, sterile physiologic sodium chloride solution or water and the operative field is draped. The exposed viscera are returned to the peritoneal cavity. All old suture material is removed. Wound edges, including skin and superficial fascia, are excised in addition to necrotic or frayed rectus sheath, muscle and peritoneum. The wound is closed with steel wire through all layers over a rubber tissue drain as illustrated (fig. 1). The skin is closed with interrupted silk. It is not believed that these patients with secondary closure should be ambulated early. The drain is loosened in five days and entirely removed by 7 to 10 days, depending upon the quantity and type of drainage. The skin sutures are removed in the usual time and the wire sutures in 14 to 16 days if the wound is clean.

The time interval between recognition of disruption and wound repair in this series varied from one hour to more than a day (table VI). The majority (75 per cent) were repaired in the first six hours.

Individual preference of the surgeon, guided by the condition of the wound and past experience in dealing with the complication, explains the following varied methods of repair in the 79 patients treated.

1. Through and through wires through all layers without separate layer closure..... 51
2. Through and through wires through all layers, combined with separate suture of peritoneum or fascia or both..... 12
3. Stay sutures of wire or braided silk (deep to fascia) combined with suture of peritoneum or fascia or both..... 6
4. Stay sutures of wire or braided silk (deep to fascia) alone..... 5
5. Buried heavy wire retention sutures through peritoneum and fascia..... 2
6. Various forms of layer closure..... 3
7. No repair..... 1

80

TABLE VI

*Interval in Hours Between Disruption and Repair*

| Hours | Disruptions | |
|---|---|---|
| 1 | 17 | |
| 2 | 16 | |
| 3 | 15 | 75% |
| 4 | 3 | |
| 5 | 5 | |
| 6 | 4 | |
| 10 | 1 | |
| 11 | 3 | |
| 12 | 2 | |
| 15 | 1 | |
| 24 or over | 12 | |
| No repair | 1 | |
| Total | 80 | |

The anesthetics used in the 79 repairs were: general 53, spinal 21, and local 5. It is believed that local anesthesia is a poor choice and should not be employed unless there is no alternative.

Of the 60 patients who lived after secondary closure, further hospitalization averaged 20.5 days from the day of repair. The extremes were from 3 to 48 additional hospital days.

## MORTALITY

The mortality rate was 25 per cent. Of the reported 80 cases, 27 patients had carcinoma. Of the 20 who died, 11 had carcinoma. The immediate causes of death are recorded below:

| | |
|---|---|
| Peritonitis (with obstruction 1, pneumonia 1, fat necrosis 1) | 5 |
| Carcinomatosis | 4 |
| Uremia (with biliary fistula 1, cardiac failure 1) | 3 |
| Coronary occlusion | 2 |
| Anesthesia (failure to react) | 2 |
| Hepatorenal syndrome | 2 |
| Hepatitis (with nephrosclerosis and pulmonary edema) | 1 |
| Exsanguination from duodenal ulcer | 1 |
| | 20 |

In 19 of the patients who died, the disruption was complete and in 1, incomplete.

## COMMENTS

The incidence of disruption at the University Hospital is too high compared to the more recent reports. Tweedie[3] reported an incidence of 0.51 per cent in a 12 year study comprising 22,311 incisions. Gross[1] reported an incidence of 0.99 per cent in a 20 year study comprising 8319 operations. In this same report, it was noted that in each succeeding five year period, the rate dropped until it reached 0.39 per cent for the period 1946 through 1950. Wolff[4] reported an incidence, however, that was even higher than this study. In a series of 1700 operations, that author recorded an incidence of 2.6 per cent.

The mortality rate of 25 per cent in this review proved disappointing. It could be assumed that, in these days of better anesthesia, better hydration, freer use of oxygen and whole blood, keener attention to distention and alimentary decompression, attention to a dry tracheobronchial tree and the control of infection by antibiotics, the mortality rate of disruption would be considerably reduced as compared to reports of several decades ago. Such was not the case.

The authors agree with other writers on this subject, that disruption is due to a combination of factors. However, the outstanding direct cause in these 80 patients was coughing, distention or vomiting, occurring singly or in combination, which were noted in 95 per cent of the patients. Coughing alone was cited as the precipitating factor in 21 patients. Tweedie[3] recorded these 3 complications as occurring in 75 per cent of 113 disruptions.

From these observations, it may be concluded that more attention should be directed to the presence of distention, to alimentary decompression, to aspiration of the tracheobronchial tree and to the early recognition and correction of atelectasis. Unfortunately, alimentary decompression by the various tubes is not automatic. The presence of a tube in situ does not necessarily mean that it is functioning. Distention must be noted and tubes checked frequently for patency if siphonage is to be efficacious.

If, at the close of an abdominal procedure, there is indication to aspirate the bronchial tree, it should be done before the wound closure or while the patient is completely anesthetized. Otherwise, stimulation by aspiration may cause such coughing that sutures are torn and disruption may be under way before the patient leaves the operating table.

When coughing is present, perhaps some cases of evisceration can be prevented if the patient is advised to flex the thighs on the abdomen and support the wound with firm pressure by the hands during the seizure. At least, it can do no harm.

In 11 of the reported disruptions, there was neglect in correcting a pre-existing anemia. In 25, the blood proteins were below 6.5 mg. per cent. Except in outright emergencies, there is no excuse for doing operations before correcting these deficiencies. Particularly is this true in patients with carcinoma who are so prone to be anemic. Blood volume studies, if available, may prove to be of great help in preparing the elderly patient for operation.

## CONCLUSIONS

During a five year period (1948 to 1952) a total of 4177 abdominal operations were done, excluding herniorraphy and McBurney incisions, at the University Hospital, Baltimore, Maryland.

The incidence of wound disruption was 1.9 per cent.

The average age was 54.9 years. It occurred over four times more frequently in males.

Disruption occurred more frequently in upper abdominal incisions.

In the 80 disruptions, the type of suture material was irrelevant.

Coughing, distention and vomiting, occurring singly or in combination, were the precipitating factors in 95 per cent of the cases reported.

Disruption was most frequent between the seventh and the eleventh postoperative days (55 per cent), but ranged from 1 to 18 days.

The mortality rate was 25 per cent.

Hospitalization after repair of the disruption averaged 20.5 days.

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# LUMBAR SYMPATHECTOMY IN ORGANIC PERIPHERAL VASCULAR DISEASE*

GEORGE H. YEAGER, M.D., R. ADAMS COWLEY, M.D.,
HUGH P. CURTIS, M.D.

*Baltimore*

The antiquity of arteriosIcerosis can be traced far back in the history of man. The opinion that it is a disease of modern times, related to modern nutrition and the physical and mental strains of modern life, is contradicted by objective findings of atheromas and atheromatous patches in specimens of arteries obtained from mummies.

It is well appreciated that as a phase of our biologic heritage, alteration in the blood supply to tissue is an inevitable process of body involution. Less appreciated, and often difficult to interpret, is the physiologic fact that a variable secondary vasomotor spasm may be associated with many organic diseases of the blood vessels. Frequently, this secondary phenomenon may account for the severity of ischaemic symptoms, and may be the determining factor in the production of tissue devitalization. In a high incidence of patients, sympathetic pathway extirpation operates not by removal of diseased tissue but by alteration of function. Removal of this secondary sympathetic nervous mechanism will afford relief of pain and salvaging of the affected part from death by gangrene.

Disturbance in the normal amount of circulating blood in peripheral vascular disease is dependent upon two factors, either or both of which may be present: (1) obliterative physical change; (2) abnormal spasticity. The relationship of both factors should be evaluated carefully in order to establish a logical and rational therapeutic regime.

The goal of treatment is to increase the available circulation to the affected limb. Conservative therapy, including paravertebral novocain blocks and the utilization of the various sympatholytic and adrenolytic blocking agents, may deserve a trial in certain well selected cases. It has, however, been our experience that surgical extirpation of the related sympathetic system affords the only really dependable and efficient method of eliminating vasoconstrictive gradients.

Well selected cases of occlusive arterial disease uniformly show a satisfactory response to ganglionectomy. These patients, however, should be subjected to such a procedure only after cautious evaluation, and after it has been determined that conservative therapy will not accomplish the degree of improvement anticipated by ganglionectomy.

As a guide in therapy, and in order to establish a prognosis, studies should be made to differentiate the degree of organic occlusion and associated vasospasm. It is our impression that a certain number of patients will demonstrate greater objective improvement following lumbar sympathectomy than can be predicted

* From the Departments of Surgery, University Hospital and Baltimore City Hospitals, Baltimore, Maryland.

by any specific test or study now current. If sympathetic blockading produces a drop of peripheral temperature, the procedure is contraindicated. Many of our patients showing neither rise nor drop of peripheral temperature after blocking the lumbar sympathetics with novocain, nevertheless have shown remarkable subjective and objective improvement following lumbar ganglionectomy.

Sympathectomy reduces the potential pathologic vasoconstriction of the individual, without abolishing physiologic power. Theoretically, all cases of peripheral vasospasm should be relieved by sympathectomy. Clinical and laboratory observations, however, have confirmed the impression that there are several types of vasospasm, and that the autonomic nervous system does not completely control the dilatability of the peripheral arterial system.

Lumbar sympathetic ganglionectomy is the most effective means available for the production of long-acting peripheral vasodilatation. Such vasodilatation selectively reduces the resistance to the flow of blood in the area of the body in which an increased blood flow is most needed. Sympathetic denervation of the lower extremity is largely preganglionic in type and is not associated with a serious degree of regeneration of interrupted vasoconstrictor pathways. However, in order to produce lasting physiologic results, sympathetic denervation of an extremity or viscus must be anatomically complete and done in such a way that regeneration cannot take place.

In this clinic, lumbar sympathectomies in degenerative vascular disease have been done since 1939. A total of 396 patients have had either single or bilateral lumbar ganglionectomies, representing 490 operative procedures (table I). The majority of operations have been done through a muscle splitting, extra-peritoneal type of incision. Unless contraindicated, a bilateral procedure is now done as a one stage operation, on a table which can be tilted in all directions. Experience has confirmed our impression that *cross communication rami* occur sufficiently often to justify subjecting the majority of patients to a bilateral procedure, otherwise vasospastic factors may persist. In addition, we believe that it is important to focus attention on the asymptomatic extremity. Preservation of the asymptomatic extremity becomes of even greater importance if the opposite extremity is threatened with gangrene, or if it is doomed to amputation. For adequate denervation, we consider it essential to remove all sympathetic tissue from the body of the first to the fourth vertebra.

Recently, we have subjected several patients to a more extensive lumbar sympathectomy as recommended by Lilly[4]. The incision as described by Lilly gives excellent exposure, and certainly the maneuver of tracing and dissecting the sympathetic chain through the diaphragm assures complete removal of all

TABLE I

| No. of Patients | Unilateral | Bilateral | Total Number of Operations |
|---|---|---|---|
| 396 | 302 | 94 | 490 |

TABLE II

| Age of Patients | No. of Patients | Percentage |
|---|---|---|
| 34–39 | 8 | 2.0 |
| 40–49 | 68 | 17.4 |
| 50–59 | 161 | 40.6 |
| 60–69 | 117 | 29.5 |
| 70–79 | 36 | 9.0 |
| 80–90 | 6 | 1.5 |
| Total | 396 | |

fasciculi. However, since the incision requires special positioning of the patient, as well as a rib resection with mobilization of the diaphragm, it should not be done bilaterally as a one stage procedure. As stated previously, we prefer a bilateral one stage procedure, and this is feasible with the more conservative type of extirpation. Unfortunately, the few patients upon whom we have done the more extensive procedure, refused permission for operation on the opposite side. We have no clear cut impression of its advantage, but we plan to subject certain patients to it in order to compare end results with the more conservative type of lumbar sympathectomy.

Comparative starch iodine colorimetric sweat studies made on several patients have revealed less sweating in the inguinal region in patients having had the more radical procedure. However, it is our impression that the sweat pattern was changed in degree, rather than in area.

While the more radical operation may seem preferable for the sake of completeness, the first lumbar ganglia should be spared whenever possible in the male, lest the power of ejaculation be lost. Smithwick, in a reported series of bilateral removal of the first lumbar ganglion, places this loss at 54 per cent. While fully realizing that the organic vascular disease group represents an age where this may not be an important factor, nevertheless it should be taken into consideration.

In our series of 396 patients, the indications for lumbar sympathectomy comprised the relief of pain and other associated subjective symptoms and/or avoidance or postponement of amputation. This report includes only arteriosclerotic patients, with or without diabetes mellitus. It represents the collective efforts of various surgical residents as well as staff surgeons. Although we are doing sympathectomies for certain cases of thromboangiitis obliterans, as well as chronic recurrent stasis ulcers when complicated by an extensive *wet* type of dermatitis, such cases have been excluded from this study.

The age of the patients varied from the youngest at 34 years to the oldest at 89 years (table II). Pathologic confirmation of sympathetic nerve tissue and ganglion was a requisite for inclusion in this study, and was obtained in every patient in this series.

In spite of sympathectomy, there were 55 supracondylar or below the knee

TABLE III

*There were 81 diabetic patients in the series, 57 of whom had some type of amputation (39 major limb, and 18 minor limb)*

| | |
|---|---|
| Total patients | 396 |
| Total amputations | 97 (24.7 per cent) |
| Major limb | 55 (including 39 diabetics) |
| Minor limb | 42 (including 18 diabetics) |

amputations performed, and 42 transmetatarsal or toe amputations, representing a total of 97 amputations (24.7 per cent). The average amputation age was 54.4 years. The average age for the entire series was 61.1 years. In the entire series, there were 81 patients who had diabetes, 57 of whom had some type of amputation (table III).

## RESULTS

There were 11 deaths under 10 days, a mortality rate of 2.7 per cent. Genitofemoral neuralgia occurred in 6 patients. In each instance, it cleared spontaneously. It is an extremely unpleasant complication, and in order to avoid it, special care should be exercised to protect the nerve as it traverses the psoas muscle.

Any patient having a major amputation has been classified as a poor result despite the fact that his original major presenting symptom may have been an area of tissue necrosis. Any patient having a toe or foot amputation is classified as a fair result. It is believed that a successful conservative toe or transmetatarsal amputation represents circumvention of an extremity amputation.

Patients not demonstrating relief of at least one of the following symptoms, e.g. rest pain, relief of subjective cold feet, or healing of ulcerations are classified as having poor results. If at least one of the presenting subjective complaints were relieved, the results are classified as fair. If more than one or all of the presenting major complaints were relieved, the results are classified as good.

We do not do lumbar sympathectomies in arteriosclerotic peripheral occlusive disease for intermittent claudication per se, and therefore do not use an increase of exercise tolerance as a criterion for evaluating the end results of such a procedure.

A large percentage of patients will demonstrate an improvement of exercise tolerance following lumbar sympathectomy and we look upon such an increase as a most desirable occurrence. However, in evaluating indications for sympathectomy, we believe there should be criteria other than intermittent claudication. Many patients presenting themselves with a single complaint of limited exercise tolerance frequently will show improvement with more conservative measures.

Exclusive of 11 deaths, it was found that 40.2 per cent of the results were poor and that 60.8 per cent of the results were satisfactory. Under the category of satisfactory results, 32.1 per cent were considered good, and 28.7 per cent fair.

## CONCLUSION

It is our continuing impression that lumbar sympathectomy, adequately executed in properly selected cases of peripheral vascular disease, is an adjunctive procedure of merit.

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# MESENTERIC VASCULAR OCCLUSION

## A BRIEF ANALYSIS OF TEN CASES WITH A REPORT OF FOUR PATIENTS WHO SURVIVED FOLLOWING OPERATION

THURSTON R. ADAMS, M.D., BENJAMIN ADELSTEIN, M.D.

*Baltimore*

Mesenteric vascular occlusion is one of the most serious abdominal conditions seen by surgeons. Tiedemann[2] first described this condition in 1843. Since that time over 1300 cases have been reported in the literature.[3]

A review of the records of the University Hospital for the past 10 years showed that the entity has been encountered 10 times at operation or autopsy. This does not include those cases associated with strangulated hernia, volvulus, or intussusception. During the 10 year period there were 128,613 hospital admissions, giving an incidence of 1 in 12,861 admissions. Among these admissions there were 12,760 abdominal operations, giving an incidence of 1 in 1,276 abdominal operations. This is about the same incidence as seen in comparable institutions.

Mesenteric vascular occlusion may be either arterial or venous. Reports in the literature give the percentages as about equal. In this small series there were 4 cases classified as arterial and 6 cases classified as venous. Several of our patients had arteriosclerotic heart disease clinically which may have played a part in the development of the vascular occlusion. Mesenteric venous occlusion generally is considered to be caused by:

1. Infection in the abdominal cavity.
2. Trauma to the vessels.
3. Blood disease, such as sickle cell anemia, polycythemia, and splenic anemia.
4. Mechanical cases such as tumors and portal obstruction; and a few cases have been reported following splenectomy.

At times no demonstrable cause can be found. Three of our patients were chronic alcoholic addicts and this was thought to play a part in the development of the condition. The reported cases are divided about equal as to male and female. In our series there were 6 males and 4 females. There were no Negroes in our group. There were no Negroes in McClenahan's series of 40 cases.[3] Three of our patients were between the ages of 30 and 40 and 3 were over the age of 75 years. The extremes of age were 30 and 92 years.

Of this group of 10 cases, 9 patients complained of abdominal pain. The pain was described as colicky in nature by 7 patients. Eight of the group were not in shock when first seen in the hospital. One patient was in profound shock on admission and 1 other developed shock a few hours later. A silent abdomen was encountered in 4 patients while active peristalsis was present in 6 patients.

From the Department of Surgery, University of Maryland School of Medicine, Baltimore, Maryland.

Muscle spasm was elicited in only 4 patients. Vomiting was complained of by 6 patients. Abdominal distention was present in 5 patients on admission. The duration of symptoms varied from a few hours to as long as two weeks. The white blood count was elevated above 17,500 per cu. mm. in all except 2 patients who showed counts of 5,000 and 9,000 per cu. mm. The clinical diagnosis of mesenteric vascular occlusion was made in only 1 patient before operation or autopsy. Eight patients were operated upon. The other 2 patients were moribund on admission and operation was not deemed advisable.

## CASE REPORTS

Case 1. L. M. H., a 79 year old white woman entered the hospital on July 4, 1952, with a history of taking a dose of Epsom salts on the night of July 1. On the following morning on arising she had a cramping pain in her abdomen. This was followed by vomiting. The pain was intermittent in character but never entirely subsided. She described the pain as being located in the upper portion of her abdomen.

On admission her temperature was 99.4 F., pulse 90, respirations 20, and blood pressure 140/80. Abdominal examination revealed no rigidity or spasm. There was definite tenderness without muscle spasm in both upper quadrants. The remainder of the examination was essentially negative. Her white blood count was 27,500 per cu. mm. Preoperative diagsis of intestinal obstruction—etiology undetermined—was made.

The patient was operated upon. Endotracheal cyclopropane anesthesia was used. When the peritoneum was opened there was blood tinged fluid throughout the peritoneal cavity. It was noted that approximately 100 cm. of the lower ileum was becoming gangrenous. This was removed and an end to end anastomosis was done. The patient stood the operation well considering her poor condition, and postoperatively had a fairly uneventful course. Anticoagulants were not used. She was discharged from the hospital on July 23, 1952, in good condition, and still is living.

The pathologic diagnosis was mesenteric thrombosis—arterial; infarction of small intestine.

Case 2. A. T. W., a 60 year old white man was admitted to the hospital on March 24, 1951, stating that at 3 o'clock on the morning of admission he was awakened by a sudden onset of severe midepigastric pain followed by nausea and vomiting. At the time of admission he was in profound shock. It later was found that 20 years prior to his admission he had had a severe attack of epigastric pain following the ingestion of a heavy meal and fairly large quantities of beer and whisky. This attack prostrated him for four days. Following this he was completely well, but in the past year he had had what he described as recurrent bouts of heartburn. He was seen about 7 a.m. by his family physician who noted that his blood pressure was 150/90, and pulse 96. He described his pain as being beneath his xiphoid and it was thought that probably he had a coronary occlusion. He was given morphine and atropine without relief. When again seen by his family physician at about 3 p.m. he was cyanotic, pulseless, and his blood pressure was not obtainable. He was sent immediately to the hospital.

On admission his temperature was 99.4 F., respirations 20, pulse not obtained. His blood revealed a hemoglobin of 19.5 grams, hematocrit 63, and white blood count 17,500 per cu. mm. A portable electrocardiogram revealed no evidence of acute myocardial infarction. He was given oxygen by mask and started on 10 per cent glucose intravenously with 1 cc. of Neosynephrine in each 500 cc. In addition he was given blood plasma. About three hours after admission, on this therapy, his pulse was obtained and his blood pressure reading was between 85 and 90. His apical pulse varied between 92 and 100. During the first 12 hours after admission he received 1000 cc. of whole blood, 4 units of plasma, and 1500 cc. of glucose and saline with added Neosynephrine. During this period his blood pressure varied between 50 and 80 diastolic and 70 to 90 systolic, and the pulse varied between 85 and 110. About

9 a.m. the intravenous needle came out of his vein and he again went into shock. For a period of two and one-half hours he was pulseless and no blood pressure could be obtained. At that time his left saphenous vein was exposed and a cannula was inserted. He was given saline with Neosynephrine and plasma and whole blood. By 3 p.m. his blood pressure had stabilized at about 110/80. During this interval his abdomen became more distended and more and more rigid, and it was thought that he had an acute surgical condition in his abdomen. His serum amylase was 105 and his hemoconcentration was slightly reduced, the hematocrit being 57.

About 3:30 p.m. he was operated upon. On opening the abdomen there was considerable quantity of blood tinged fluid found. The presenting small intestine was purple in color. The involved bowel was approximately 150 cm. in length. The gangrenous portion was resected, and because of the difference in the caliber of the bowel ends, the ends were closed and a lateral anastomosis was done.

Postoperatively the patient was given Depoheparin and Dicumarol. His postoperative course was uneventful and he was discharged from the hospital on April 4, 1951. He still is living and has had no further difficulty.

The pathologic diagnosis was mesenteric thrombosis—venous; early necrosis of small intestine.

Case 3. J. F., a 54 year old white man, with known diabetes and arteriosclerotic hypertensive cardiovascular disease, was admitted to the hospital on July 13, 1948. He stated that one day prior to admission that he had had abdominal pain which was colicky in nature.

Examination on admission showed that he was a diabetic and that his heart was fibrillating. His temperature was 98.6 F., pulse 80, respirations 20, blood pressure 204/100. The skin of his extremities was cold and clammy. There were a few rales in the base of both lungs and on questioning him it was found that he had been taking digitalis for some time. Abdominal examination showed that his muscles were relaxed; his liver was slightly tender and enlarged about 4 fingerbreadths below the costal margin. The spleen was enlarged and firm, extending 2 fingerbreadths below the costal margin. No other abnormalities were found. A rather routine medical work-up was followed. Electrocardiogram showed fibrillation and evidence of having taken digitalis. A Roentgenogram of his chest showed the lungs reasonably clear; the heart was moderately enlarged. Flat films of the abdomen showed only the enlarged liver and spleen. The gallbladder was not visualized after the oral administration of Priodax. The esophagus and duodenum were reported as negative. Barium enema was negative. During the time of this examination he continued to complain of vague abdominal discomfort and it was noted that a mass was developing in his left upper quadrant which had not been felt previously. His abdomen at this time was showing a little more distention, and it was the impression that he had a carcinoma of the colon. Operation was advised.

At operation there was a moderate quantity of blood tinged fluid present and a large mass of small intestine was present in the left upper quadrant. There was considerable fibrinous exudate over this bowel. When this was cleared away it was seen that the bowel was discolored and becoming gangrenous in areas. It was found that the involved bowel extended from about 2 inches distal to the ligament of Treitz down his jejunum for approximately 70 cm. This area was resected and an end to end anastomosis was done.

The postoperative course was complicated by congestive heart failure which slowly improved, and by an infected incision which had to be opened and drained. Dicumarol was used as an anticoagulant postoperatively. He was discharged from the hospital on Aug. 15, 1948. A follow-up note on this patient recorded that he died approximately one year later from a cerebral thrombosis.

The pathologic diagnosis was gangrene, small intestine; and thrombus noted in one artery.

Case 4. M. W., a 60 year old white woman, was admitted to this hospital March 30, 1952, because of cramp-like abdominal pain with nausea and vomiting. She had been sick for approximately six weeks with vague pain in her abdomen, and was admitted to another hos-

pital where a general work-up was done and she was discharged as having a partial obstruction of the bowel. She continued to have periumbilical pain which came on about 15 minutes after eating. The last attack began 24 hours before this admission and had slowly become worse.

Examination on admission showed moderate distention of her abdomen with a few high pitched tinkles. There was a fairly marked generalized abdominal tenderness without any particular localization. Blood studies showed a hemoglobin of 14.9 grams, a white cell count of 18,300 per cu. mm. and a hematocrit 48. The temperature was 97.6 F., pulse 130, and respirations 26. The blood pressure was 140/88. Flat roentgenogram of the abdomen did not reveal any unusual pattern. A diagnosis of intestinal obstruction was made.

At operation a segment of the lower ileum about 13 cm. in length appeared to be gangrenous. No other abnormality could be found. This section of bowel was resected and an end to end anastomosis was done.

Her postoperative course was entirely satisfactory. She was discharged from the hospital April 18, 1952. She still is living and has had no further difficulty.

The pathologic diagnosis on the resected bowel was venous mesenteric thrombosis; infarction of the ileum.

## CONCLUSIONS

A brief analysis of 10 cases of mesenteric vascular occlusion is presented.

A description of the 4 patients who survived small bowel resection for mesenteric vascular occlusion is given.

Surgery offered these patients their only chance of survival.

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# THE EVALUATION AND CARE OF THE PATIENT FOR CARDIAC SURGERY

R Adams Cowley, M.D.*, Leonard Scherlis, M.D.†, Paul Hackett, M.D.‡

*Baltimore*

During the past decade, advances in cardiac surgery have resulted from an ever growing understanding of the physiology of the heart and circulation. Today, expert diagnosis and thorough preoperative evaluation make many cardiac patients, previously regarded as incalculable risks, amenable to surgical treatment. Failure in the diagnostic and preoperative evaluation areas can result in needless or even fatal surgery. Intelligent and successful planning is achieved by physicians from many branches of medicine by combining their efforts to provide a needed continuity in the care of the patient with heart disease.

At the University of Maryland Hospital in Baltimore, a joint Medical-Surgical Cardiac Committee has been organized. The committee is composed of one or more representatives from the Departments of Medicine, Surgery, Pediatrics, Radiology and Anesthesiology. This committee functions through weekly conferences at which time patients with cardio-vascular diseases are considered. The patient's history, physical findings and laboratory data are presented and the patient himself is examined by committee members. Following this, all participants discuss problems of diagnosis, management, and postoperative care of the patient. Such a conference stimulates its members to seek out better methods of diagnosis and treatment. Concomitantly, excellent opportunities are afforded for house staff education. In the final analysis, a higher level of patient care is reached.

Since the cardiovascular patient comes directly within the jurisdiction of the Medical-Surgical Cardiac Committee, he is never subjected to the problems encountered in a transfer from the medical service to the surgical service. This implies that the entire committee is responsible for patient care preoperatively, during operation and postoperatively.

Soon after a cardiac patient is admitted to the hospital, he is examined by a member of the Cardiology Department for the purpose of making a more complete study of the patient. Diagnostic evaluation of cardiac patients for definitive cardiac surgery requires many laboratory facilities and the cooperation of trained teams employing specialized technics.

After a routine history and physical examination are obtained, cardiac fluoroscopy is done primarily to determine specific chamber hypertrophy, presence of

* From the Cardio-Pulmonary Laboratory of the Department of Surgery,
† The division of Cardiology, Department of Medicine and
‡ The Department of Anesthesia of the University of Maryland, School of Medicine, Baltimore, Maryland.

calcified valves and size and pulsation of the great vessels. Roentgenograms of the chest are secured for verification of fluoroscopy and for a permanent record.

The routine electrocardiogram is supplemented by the recording of spatial vectorcardiograms. In our experience, such records have been found to be helpful in establishing an early diagnosis of right ventricular hypertrophy and in distinguishing right ventricular hypertrophy from right bundle branch block.

When coarctation of the aorta is present, ballistocardiograms are recorded for comparison with postoperative tracings and for correlation with the improvement in femoral pulsations, rather than for diagnostic purposes.

Oximetry is used for patients with minimal cyanosis to determine the increased degree of right to left shunt and the depth of cyanosis following exercise.

For exact analysis of murmurs, and as a means of permanent registration, sound tracings of the murmurs are recorded. Pulse tracings are simultaneously recorded with electrocardiograms, and are extremely valuable in the analysis of these stethograms. In addition, liver and jugular tracings afford information as to tricuspid valve disease, while carotid tracings are of value in the evaluation of aortic stenosis and aortic insufficiency.

All patients with cyanotic congenital heart disease and most of those with noncyanotic congenital heart disease require cardiac catheterization. A well-trained team for cardiac catheterization reduces complications to a minimum. Throughout the procedure the electrocardiogram is monitored on an oscilloscope and permanent tracings are recorded on a four channel direct writing cardiograph. Constant fluoroscopic control of catheter manipulation is essential. Members of the team should have specifically assigned roles. One individual should be free to supervise the entire procedure, to assist in determining the cardiac output and to exercise the patient. Evans Blue and radioactive substances may be injected into the right auricle and right ventricle during the cardiac catheterization to evaluate the level of a right to left shunt. Chromium tagged red blood cells and radioactive iodinated human serum albumin are utilized for the measurement of blood volume.

Many patients selected as potential candidates for mitral surgery are catheterized with emphasis on right ventricular and pulmonary artery pressures, cardiac output and changes with exercise. Pulmonary capillary pressure tracings are recorded, but are of questionable value in distinguishing mitral stenosis from mitral regurgitation.

Angiocardiography and aortography are carried out in all cases of coarctation and aneurysm of the aorta and for visualizing anomalous pulmonary veins and arteriovenous fistulas. In certain instances they are used for the purpose of evaluating the level of right to left shunts.

After these studies have been completed, the patient is ready for presentation to the Medical-Surgical Cardiac Committee.

Every effort is made to have the patient in optimum condition for operation by the judicious use of digitalis, diuretics and antibiotics. An attempt is made to have the patient understand what will be done and how he may best cooperate

with the anesthetist and surgeon. It should be stressed that *optimum condition* implies more than *well-compensated*, since attention must also be given to the patient's adjustment to the important threat of a major surgical procedure. This is especially true in the chronically ill patient whose role in his environment has been, until this time, determined by his poor cardiac status. The position of complete, or even partial, dependency on others is not readily given up by many individuals.

During the surgical procedure, a cardiologist is in constant attendance. The patient's electrocardiogram is monitored on an oscilloscope, and frequently is recorded on a direct writing cardiograph. While no routine drugs are given to suppress arrhythmias prophylactically, an intravenous solution of 0.2 per cent procaine is immediately available if myocardial irritability should develop.

The specific anesthetic technics and agents employed have no great influence on the outcome of cardiac surgery if the anesthetic is managed by a competent anesthetist using the agents most familiar to him. Anesthesia for cardiac surgery is anesthesia for an extremely poor-risk patient who tolerates the depressant effects of any general anesthetic in the usual dosages unsatisfactorily and who, in spite of these features, must adjust physiologically to the additional burden of an open chest procedure. Some degree of liver damage usually is present due to previous episodes of decompensation. This necessitates the avoidance of hepatotoxic agents as well as those drugs that are detoxified by the liver. Thickened pulmonary capillary walls may decrease the diffusion of oxygen and carbon dioxide, and ventilation may be difficult because the lungs have lost their normal elastic recoil. The myocardial reserve often is diminished. Because of this condition the myocardium especially is vulnerable to the depressant effects of the anesthetic agents and other insults of an anesthetic course. The anesthetic management of the patient for cardiac surgery is directed towards maintaining homeostatic balance, oxygenation, and effective elimination of carbon dioxide.

Selection of the proper depth of anesthesia requires a balance of adequate operating conditions, without depression of the myocardium and the autonomic nervous system, as opposed to the comfort of the patient, who desires amnesia and analgesia.

The patient is rendered unconscious with pentothal and nitrous oxide oxygen. Ether anesthesia then is administered until surgical anesthesia is reached. The larynx, trachea and pharynx are topically anesthetized and the endotracheal tube inserted. The anesthetic then is rapidly lightened until the patient responds to the anesthetist's questions by nodding his head. Anesthesia then is maintained at this level with no discomfort to the patient who has no memory of the event. This concept provides, in our experience, the safest possible management of the cardiac patient.

Both during and after the operation, pressure tracings are obtained from the pertinent cardiac chamber and great vessels. These are employed as an index of the efficacy of the procedure and for later evaluation.

Following operation, postoperative care and management remains the responsibility of the cardiac committee.

## CONCLUSIONS

As the art of cardiac surgery becomes more exacting and as more anatomic lesions are subjected to direct attack, there arises, in direct proportion, a need for specific diagnosis. This requires the availability of laboratory facilities and teams of personnel able to perform the necessary studies. Throughout every phase—preoperative, operative, and postoperative—there is a need for frequent consultation and for continuity of patient care. We have found that the Medical-Surgical Cardiac Committee provides the answer to these problems.

# BRONCHIECTASIS: OBSERVATIONS UPON SEVEN HUNDRED AND FIVE CASES

WILLIAM L. GARLICK*, M.D.

*Baltimore*

Bronchiectasis, that foul-breathed disease of the early and middle decades of life, characteristically debilitates its victim by long, chronic infection, purulent sputum and its unsociability. It is prone to light up into a pneumonia-like illness with prostration and fever, so that the patient emphasizes its existence by the recurrent winter episodes of malaise. It relatively is pain free except for a sensation of heaviness in the chest wall. There are joint pains, muscular stiffness and weak physical stamina, but the most persistent and annoying evidence of the disease is a persistent and productive cough, with a large quantity of foul purulent sputum in the early morning which occasionally is blood streaked.

Seven hundred and five diagnoses of bronchiectasis have been made in the years from 1946 to 1954 in three hospitals of the University of Maryland System of Hospitals—University Hospital, Mercy Hospital and Baltimore City Hospitals. One hundred and thirty-six patients were submitted to operation with nine deaths. Only about one-sixth of the patients seen were given the benefit of surgery. Of those patients who could be followed (mainly private patients) there was none who was in as poor health as he had been previous to the surgery. All, as a group, had gained weight; were able to do work which had been impossible before surgery; did not tire as easily and more or less could lead essentially healthy lives. The majority had some residual morning cough, but very little if any sputum and no hemoptysis (after the third postoperative week). The patients in the younger age group (from 9 to 20 years of age), had not only gained in weight, but had grown in stature and were able to enter into all of the athletic games of their contemporaries. There was a small number of patients—about one-fifth of those operated upon—who, after surgical convalescence, had no symptoms. These usually were patients with moderate disease, unilateral in character and usually were limited to the basilar segments of the left lower lobe and the lingula. Several patients with bilateral disease, who had had the more severe segmental involvements surgically removed from one side, were so much improved and evidence of disease was so much reduced that the necessity for further surgery was doubtful. However, regardless of the symptomatic improvement, repeated bronchograms showed no radiologic evidence of change and healing of the lesions of the remaining bronchiectasis. Several patients, all women, exhibited some dyspnea after bilateral operations upon a variable number of segments, usually lingula with left lower lobe and basilar segments on the right (fig. 1). Bilateral resections have a certain morbidity rate. The dyspnea on exertion is persistent after operation for long periods of time, and

* Associate Professor of Thoracic Surgery, University of Maryland, School of Medicine; Chief of Thoracic Surgery of Mercy Hospital; Visiting Thoracic Surgeon of Baltimore City Hospitals.

FIG. 1. The bronchogram in this patient was made in two stages. This film is of the right bronchial tree made one week following the left bronchogram. The sacs of bronchi have retained the iodized oil without excretion on the left.

there was an extended convalescence of more than a year in this group. In each of these patients extensive disease required operation upon the opposite side. There was evidence in each patient also of more than usual pleural thickening with restricted movement of each leaf of the diaphragm.

A review of the surgical group gave the impression of satisfactory definitive surgery which was curative in the majority of instances. Those patients in whom all of the segmental disease was removed, and who successfully ran the gauntlet of preoperative and postoperative care, were absolutely cured. There was a second group with minimal symptoms who had some remaining disease, but who were greatly improved clinically.

The causes of death in the series were similar to those in any surgical series. In any group of patients which includes the lowest economic levels certain patients who were poor risks were selected for operation. This was an older age group of patients with emphysema, various cardiac pathologic states, alcoholism, and other conditions which complicated the bronchiectasis and the preoperative preparation, resulting in postoperative deaths. Errors in judgment of selecting poor-risk patients for operation accounted for seven deaths. Cardiac arrest caused one death. Embolism of the pulmonary artery occurred in 1 patient

with death.[2] The morbidity rate was increased by the occurrence of wound disruption of the bronchus in 3 patients resulting in empyema requiring further surgery.

In the postoperative period a more uneventful convalescence has been achieved with a variation of the standard thoracotomy incision. A step is added consisting of division of the intercostal nerve, artery and vein above and below the line of incision beyond the angle of rib posteriorly. With this incision it is believed that the patients' narcotic requirement is less. He is more inclined to take deeper breaths and to turn more readily. Although there is some surface anesthesia which persists for several months there have been no other untoward effects noted. Also, in the postoperative period, it has been our experience that anoxia developing after the period of anesthesia and operation, is related to the quantity of intravenous fluids given. If all evidence of shock has been controlled and blood loss replaced by the end of the procedure, intravenous fluids are withheld to the minimal requirement based on urinary output. We believe that anoxia, pulmonary edema and cardiac failure in this way have been lessened.

Etiologically, the series of 705 cases fall into four groups: (1) secondary bronchiectasis which consisted of the greatest number (fig. 2), (2) bronchiectasis following tuberculosis (fig. 3)[3], (3) congenital bronchiectasis (fig. 4), and (4) the middle lobe syndrome (fig. 5). Each group produced rather typical and standard roentgenographic pictures of the disease.

There were 14 pneumonectomies and 28 lobectomies. The remaining surgical

FIG. 2. The bronchogram shows extensive disease involving left lower lobe, lingular and two segments of the right lower lobe.

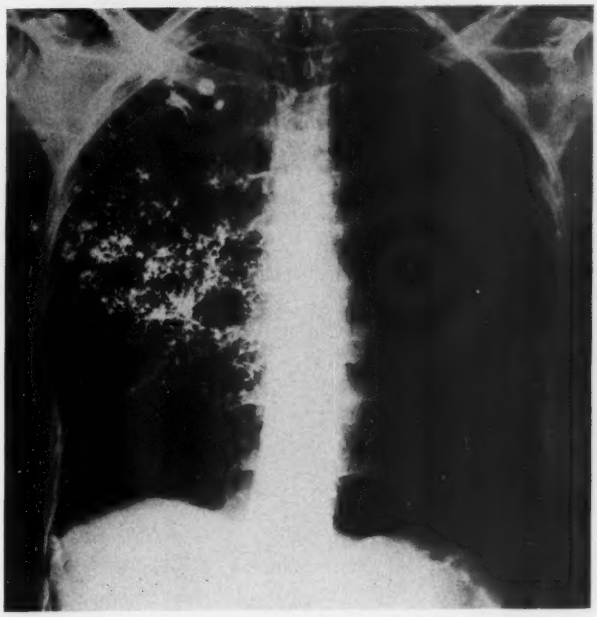

FIG. 3. The bronchogram clearly shows the clubbed character of the bronchus following tuberculosis.

procedures were segmental resections,[4, 5] the most common being basilar segments of the left lower lobe, and the lingular and basilar segments of the right lobe. The mortality rate was in no way related to the amount of lung tissue removed, i.e., all of the patients who had pneumonectomies survived.

Five-sixths of the series, 569 patients, were diagnosed as having bronchiectasis but were not submitted to surgical treatment. These may be classified in groups as follows:

1. In the first group, there are only 5 patients who could be said to have healed spontaneously. In each patient bronchograms were obtained showing minimal to moderate disease. In no instance was there evidence of bronchial stricture. After periods of 3 to 10 months of intensive antibiotic therapy, expectorants, bronchial dilators and appropriate rest and diet, no clinical evidence of the disease was present.

2. In the most prominent group the patients had minimal to moderate disease and a medical regime of careful supervision resulted in the control of symptoms. This consisted of prolonged antibiotic therapy, bed rest in the acute episodes of pneumonitis, expectorants, bronchial dilators, adequate rest, vitamin and iron therapy and other supportive measures. In several instances patients were advised to seek dust-free places of employment or urged to seek employment in which there were no aggravating pulmonary factors. More than 300 patients fell into this group and their diseases were apparently satisfactorily controlled

FIG. 4. The bronchogram shows complete sacculation of the left lung in a congenital, primary type of bronchiectasis.

to such an extent that they were not advised by their physicians to seek surgical treatment. The bronchograms of this group were spot checked. It became apparent that the majority had two or more segments involved, but rarely five. After being placed on antibiotic therapy and, if smokers, being encouraged to dispense with the lung irritant, clinical symptoms became sufficiently controlled to cause patient and physician to hesitate to resort to definitive surgical therapy. I have been unable to evaluate whether in such patients the disease will remain stationary or will continue progressive. Certainly, large numbers of patients are more or less controlled on medical routine treatment and are sustained in reasonably good health so that they do not seek nor are advised to have surgical intervention. However, it should be stated at this point that, other than the provocative group 1 the only method of definitive therapy for bronchiectasis is the surgical removal of the diseased segment.

3. A third group of more than 100 patients, had had a diagnosis of bronchiectasis made on the basis of clinical symptoms alone. It is true that a presumptive diagnosis of this disease may be made by suspending the sputum in a jar of water, and by teasing the muco-purulent material of freshly coughed up sputum. Or, as was occasionally done, a diagnosis of bronchiectasis was assumed because a patient had recurrent bouts of pneumonitis and fever each winter and a history of persistent cough with sputum. Or, in a patient whose chest film showed increased bronchial markings lying behind the sharp heart border or breaking it into an irregular line, a diagnosis was presumed. But in none of these is a diagnosis assured. Since Sicard and Forestier[6] in 1922 introduced the use of

iodized oil as a contrast medium to outline the bronchial tree, it has been a necessity for the diagnosis of bronchiectasis. Without a properly executed contrast picture of the bronchial tree, no such diagnosis may be accurately made. A prime requisite of a bronchogram is that each division of second degree bronchi must be shown in each lobe and each segment in order that the extent of the disease may be completely mapped and the patient properly evaluated.

Many of these patients were of interest in review. Rather typical was a patient, a Negro female, who, on her fourth hospital admission, was diagnosed as having sarcoidosis. A second, also a Negro female, who had been presumed to have bronchiectasis because of recurrent bouts of pneumonitis, was diagnosed eventually as having lupus erythematosis. Two white men in the fifth decades of life,

FIG. 5. This spot film of the bronchogram shows a large eroded gland, obstructing the middle lobe bronchus.

FIG. 6. A spot film of the bronchogram shows the right main bronchus containing a tumor, and the previously diagnosed bronchiectasis distal to it. A catheter is in the trachea.

on their second hospital admissions had obvious lesions which on thoracotomy were shown to be carcinomas of the bronchus (fig. 6). A presumptive diagnosis of bronchiectasis without adequate bronchograms can, therefore, be dangerous to the welfare of the patient. It is an interesting fact that, on the basis of the theory of chronic irritation and inflammation influencing the occurrence of carcinoma, only 2 patients in this large series who had previously been diagnosed as having bronchiectasis developed bronchogenic carcinoma—proved by excision.

4. A fourth group consisted of patients who, because of the severity of other disease states in conjunction with bronchiectasis, were judged to be inappropriate for surgery. The majority were persons with various types of cardiac pathology, arteriosclerosis, hypertension, chronic nephritis, diabetes and other generally *poor-risk* patients. As a whole, in review, this group received the most detailed study and evaluation. The refusal of surgery to them was in each instance above criticism and justified.

A treatment other than medical or surgical has been applied to bronchiectasis—bronchoscopy—repeated and frequent. A number of patients have been relieved of their symptoms and carried for a number of years by bronchoscopic removal of the collection of detritus in the lower bronchi. One of the bronchoscopists had, for one extenuating circumstance or another, treated some 20 patients in 1946

by regulated bronchoscopic aspiration. Of these 20, only 2 remained under such treatment in 1954. Each patient was placed on a routine of postural drainage with other appropriate therapy and at intervals of one week to three months, depending upon the quantity of sputum, the flare-up of a pneumonitis or weight loss, was seen and his bronchi aspirated as clean as possible. After a few bronchoscopies at short intervals it was possible to lengthen the time between attacks so that, in several instances, only three or four aspirations a year were sufficient to control the symptoms. Only 2 of these patients have been carried the full eight years. Each has refused surgical intervention. Of the remainder, 7 have had surgical removal of the diseased portion of lung. Eleven have died of other diseases, including lung abscesses. It would seem from these few cases that bronchoscopy may temporize and alleviate immediate symptoms of the disease, but that it is in no way curative and is used better in the preparation of the patient for surgery if circumstances will allow it.

In one of the three hospitals in the period from 1930 to 1939, 59 patients were charted as having bronchiectasis; from 1940 to 1949, 35 patients were discharged with a diagnosis of bronchiectasis; and from 1950 to 1954 only 9 have been so diagnosed. One factor which may play a part in the decreasing number of hospital cases so diagnosed, is the requirement of a bronchogram before the diagnosis is charted. It would appear that many cases of chronic bronchitis from whatever cause, perhaps have been included in this category previously. The excellent pediatric care[1] with the control of whooping cough, the pneumonia of measles and the more primary pneumonias, better early treatment of sinusitis in both the juvenile and adult, have some bearing on the development of bronchiectasis and the present therapeutic methods on the occurrence of fewer cases.[7] Four cases of infantile or congenital bronchiectasis are recorded in the period between 1930 to 1939; 5 cases were recorded in 1940 to 1949; and 2 cases have been noted between 1950 to 1954.

From this series it was attempted to define which patient was a candidate for surgery in the opinion of the present day general practitioner. It became clear that the general judgment of a large number of practicing physicians came into agreement that operation is indicated in only three types: 1. The healthy young individual who has copious quantities of sputum and who has more than two pulmonary segments involved, but less than three entire lobes (considered in segments) involved who exhibits signs of chronic illness. 2. The patient with moderate to severe hemoptysis. 3. The older age group of patients whose existence is jeopardized by severe symptoms of the disease with influences on systems other than respiratory, such as gastrointestinal or cardiac.

There were no patients who had minimal bronchiectasis operated upon. In contrast to this viewpoint, it is the accepted fact that the degree of bronchiectatic involvement of the lungs is no criterion for the basis of definitive surgical therapy. Many patients who have one segment involvement to subsegmental involvement require surgery for the removal of a disease state which *triggers* a gross pneumonitis of recurring nature. The only tenable approach is surgical when the diagnosis is made if other circumstances warrant such treatment.

In the preparation of the patient for operation, a tracheostomy is indicated in certain patients. We have thought that if the patient who has copious quantities of sputum after admission to the hospital which does not decrease with routine supportive care by rest, antibiotics, bronchial dilators, 5 per cent carbon dioxide and 95 per cent oxygen inhalations, postural drainage and other measures, and in whom if the possibility of tracheostomy is considered postoperatively, it is safer for the patient, much less alarming, and more expeditious to do this simple procedure before the thoracotomy.

SUMMARY

Observations have been made upon 705 patients who had bronchiectasis and who were admitted to three hospitals. The results of treatment have been noted as accurately as is possible in reviewing the work and judgment of a large number of physicians. Suggestions have been made in the diagnosis and the preparation of patients for surgery.

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# RETROPUBIC PROSTATIC SURGERY

HOWARD BROOKS MAYS, M.D.

*Baltimore*

The anatomically satisfying extravesical approach allowing direct visualization of the prostate, termed retropubic prostatic surgery, has gained a noteworthy position of importance since it was popularized by Millin in 1947. We were not at first enthusiastic regarding this procedure at the University Hospital and perhaps this reluctance may have helped us avoid some of the disappointing complications originally encountered by many. However, since adopting the retropubic approach it constantly has gained favor and has become established as a standard procedure at the University Hospital and the allied components of the University of Maryland. In an effort to maintain a well rounded teaching program the various surgical approaches to the problem of disease of the prostate are taught. Suprapubic, transurethral and perineal prostatic surgery have maintained in the past and continue to maintain definite positions of importance in the surgical armamentarium. Retropubic prostatic surgery has not entirely supplanted these other methods; however, experience has demonstrated that the retropubic approach has steadily evolved into the procedure of choice when feasible.

The approach has been generally accepted by a group of very severe critics. Our residents in general surgery, who long had been taught the suprapubic approach as the means of handling the less complicated prostatism problems, soon showed interest in this newer procedure and have widely adopted it for use throughout a broad geographic area. The nurses who have attended prostatic cases prior to the advent of this method universally are enthusiastic, and indeed their problems have been greatly simplified in many instances. The family physicians of the patients have been outspoken in favor for the reason that the most serious group of critics—their patients—are satisfied. Many factors account for the changing attitude of the patient faced with impending prostatic surgery. Not the least of these is the favorable reputation gained by retropubic surgery in the patient's circle of acquaintance. That these procedures have found popular acclaim among patients is understandable when one considers that postoperative urinary continence is an almost universal result. Although an estimation of the retention of potency is difficult to determine it almost generally appears to be satisfactory following this type surgery for the benign gland. In our experience postoperative complications have been relatively rare and the hospital period comparatively short. The large number of reports attest the fact that many urologists have critically analysed the approach and found it valuable. It is my firm belief that the general surgeon who performs an occasional prostatectomy, who has not explored the advantages of the retropubic approach, will find it meritorious if he will familiarize himself with the procedures and indications for employment.

Encyclopedic coverage of the subject of retropubic surgery is not the purpose of this presentation nor are specific detailed surgical technics described. A detailed statistical review will serve no laudable purpose other than to demonstrate the basis for the enthusiasm with which we view the subject. The retropubic approach has been satisfactorily employed for benign prostatic hypertrophy, prostatic carcinoma, contracture of the bladder neck, urethral trauma, congenital valves and calculus prostatitis. Biopsy for suspected carcinoma may be obtained readily. Prostatic surgery in conjunction with a variety of diseases of the bladder and pelvis often has been employed. Limitations of the use of this approach are few. Usefulness is not limited by the size of the prostate gland and indeed the largest prostate may be removed by the retropubic approach. Obesity presents the same problem of exposure that is generally encountered in low abdominal surgery, but is not found to be the insurmountable problem as has been indicated by some reports. The presence of calculus in the bladder is not a contraindication and the removal of a single calculus or multiple calculi in conjunction with retropubic prostatectomy is a simple matter. Instances of diverticulum of the bladder and certain tumor categories, when coexisting with prostatic hypertrophy, may be handled to advantage when the prostatic phase of the procedure is corrected extravesically. In some instances contracture of the vesical neck readily may be corrected by open visible loop resection. Occasionally ankylosis of the hips or other restricting disability limit any approach other than a transabdominal one. Of prime value is the extent of exploration of the periprostatic and extravesical spaces afforded by this anterior approach to the prostate. Contrary to oft repeated statements, it is possible to adequately obtain a biopsy section of any portion of the prostate gland by means of the retropubic approach. Proper exposure of one hemisphere of the prostate is of course necessary but severance of the urethra to accomplish this end is not necessary. Direct palpation of the seminal vesical area and the availability of pelvic lymph gland biopsy is considered advantageous.

Selection and consideration of the patient for proposed retropubic surgery requires the same knowledge and experience as for the other types of prostatic surgery. One must of necessity be able to evaluate his patient and to properly interpret digital rectal examination. I can find little reason to accept the belief occasionally expressed that endoscopic examination prior to prostatic surgery is not necessary. I consider this examination mandatory in most instances. If potential infection is considered a contraindication then endoscopic study may be done immediately prior to operation without danger of increasing the infection risk. It has been our experience that one cannot accurately predict the occurrence of an infectious complication following prostatectomy. Therefore, it has been our custom, once a tentative diagnosis is established and surgery considered, to place these patients on empiric antibacterial measures using either a broad spectrum antibiotic or a chemotherapeutic agent. Obviously, when a specific type of infection has been demonstrated, acceptable therapeutic measures are promptly instituted according to sensitivity tests. Empiric therapy seems particularly indicated when catheterization has been necessary prior to

admission or performed under any circumstances other than ideal aseptic technic.

Since the scope of this presentation is not intended to cover the details of the operative retropubic approach to the benign or malignant prostate, it is assumed that those who are interested have familiarized themselves with the procedures or will give due consideration to the widely published surgical technics with especial attention to the work of Terence Millin. Particularly as related to carcinoma of the prostate the reports of Richard Chute and others merit careful consideration. Retropubic surgery does not of necessity require the use of special instruments. However, a self retaining retractor does provide better observation and is a necessity in the approach to carcinoma of the prostate. An empty bladder is considered essential. The most careful attention must be given to exposure of the prostate. The preprostatic fat and venous plexus should be pushed gently aside when possible with vessel ligation as required for presentation of sufficient anterior aspect of the prostate capsule for adequate incision. This incision should be sufficiently long to allow enucleation of the prostate without further tearing the capsule laterally into the periprostatic fossa. In the majority of instances we prefer transverse capsular incision for benign prostatic hypertrophy; however, in certain instances of bladder neck contracture, the presence of large calculi in the bladder or congenital valves, a linear incision is employed. Inattention to the important preservation of the often heavily vascularized periprostatic fossa appears to have been a source of much troublesome bleeding to those who have not learned by experience to avoid this unnecessary complication.

Next in seriousness to the improper selection of the patient for prostatic surgery is improper approach and preparation of the gland for enucleation. If the surgical field has been properly prepared at this stage there need be no danger of loss of a sense of position with unnecessary trauma to the prostate capsule and the commonly associated bleeding which has been the experience of so many in prostatic surgery. Undoubtedly one of the greatest assets to this operative procedure, as in all types of pelvic surgery and particularly prostatic surgery, is the possession of long fingers which although not mandatory are a distinct help. When obesity, a low position of the prostate, or enucleation difficulty occurs an index finger in the rectum will not only aid the removal of the prostate but in certain instances serve as a definite measure of protection for the rectum. The prostate may be enucleated within its capsule by the use of instruments, but it is the custom in our clinic to digitally enucleate the gland as completely as possible, leaving the urethra attached distally and proximally. In most instances it is possible to sharply sever the urethra immediately adjacent to the prostate within the prostatic capsule by means of curved surgical scissors. It is quite probable that forceful separation of the urethra from the prostate occasionally may be responsible for temporary or permanent incontinence. There appears to be less bleeding with sharp severance and possibly a lessened tendency to subsequent stenosis at this point. This maneuver is a debatable point since quite frequently the urethra is severed during the process of enucleation. After

deliverance of the prostate through the capsular incision the gland is carefully separated from the bladder by using blunt and sharp dissection with careful attention that the prepared vesical outlet is free of tissue tags. A hot moist pack is placed in the prostate cavity and a finger is inserted into the bladder for the purpose of digital exploration and, of greater significance, the calibration of the vesical outlet. A properly prepared bladder outlet should allow the index finger to freely pass into the bladder. At this stage the most satisfactory approach, to those familiar with prostatic surgery, is the ability to carefully control bleeding under direct vision. This step is essential. Large vessels may be surgically ligated but frequently light coagulation will suffice.

Removal of notably enlarged median lobes and subtrigonal lobes can readily be done by digital dissection without materially affecting the carefully prepared vesical outlet. An excellent opportunity is afforded for estimation of fibrosis at the vesical outlet with contracture or median bar formation. When objectionable tissue is demonstrated it may be removed by a wedge incision. In some instances there is sufficient bar formation to suggest the use of loop electrosurgical resection under direct vision, and this procedure has the added advantage of ready hemostasis for bleeding is not uncommon in this area. We prefer the balloon type catheter with the 30 cc. bag distended with approximately 20 cc. of sterile fluid with the balloon resting within the bladder lumen.

The transverse capsular incision is closed with either interrupted or continuous absorbable sutures. It is mandatory that these sutures be placed entirely through the capsule in such fashion that the incised edges are fully approximated. Usually 4 to 8 interrupted sutures, properly placed in an incision of average length, will result in no leakage when the bladder is irrigated at this stage. The prevesical space is always drained by using either Penrose type drains or small tube drains. Upon return of the patient to the ward it is our custom to attach the catheter to a closed irrigating system although this is by no means mandatory. We consider it essential that irrigation be done as frequently as the individual patient requires to prevent formation of blood clot, although this is not generally a major factor. When irrigation is deemed necessary it is done at gradually increasing intervals and usually discontinued about 24 hours following operation. In the majority of instances an antibiotic has been used for an average of three or four days following operation using again a broad spectrum antibiotic or one of greatest specificity when sensitivity tests have been made on demonstrated existing infections. Following this medication generally we employ a chemotherapeutic agent for the next three or four days. Throughout this period supplementary therapeutic vitamin administration has been widely employed and the majority of our elderly patients have received some form of supplementary vitamin therapy.

We prefer a snug surgical dressing and believe that early ambulation of the patient so dressed results in obliteration of the prevesical space with the expulsion of any accumulated serosanguineous fluid. The incision drains usually are removed on the third or fourth postoperative day and the catheter on the third to the fifth day. Noteworthy features have been the nearly universal immediate

control of the urinary flow and dry incisions from the time of catheter removal. The advantage of the latter feature need not be enumerated to anyone who has had long experience with prostatic surgery. Barring complications the patients usually are ready to return home between the eighth and twelfth postoperative day.

There may be in our clinic an apparent tendency to overmedication with the copious use of drugs often used on an empiric basis. In addition many patients have upon discharge from the hospital been advised to use some form of urinary antiseptic medication varying in type and intensity dependent upon estimated need. It is possible that herein lies the reason why there has been no case of osteitis pubis diagnosed and demonstrated following retropubic surgery at the University Hospital. One possible exception was a patient who had had a radical retropubic operation and, because of distance factor, could not be followed closely. This patient instrumented himself freely and eventually developed osteitis pubis. Occasionally stress incontinence has occurred, but is not a major problem. Occasionally postoperative calibration and urethral dilatation has been required, especially in patients with known pre-existing infection. A surprising number of patients have volunteered the statement that potency has not been materially affected. Noteworthy is the fact that interest regarding potency is general in all prospective patients in reasonably good health.

There has been considerable discussion regarding the supposed limitations of the retropubic approach to suspected cancer of the prostate. It is not the purpose of this discussion to draw biased or unfavorable comparisons. One cannot question the adequacy of the perineal approach for biopsy section of the prostate gland. This approach long has been advocated and has been found satisfactory by many. The retropubic approach does not exclude biopsy section nor is it mandatory, as has been suggested, that the urethra be severed to allow proper approach to the inferior surface of the gland. Biopsy section of either hemisphere is possible by dissecting free the lateral attachments on the side of the gland where the clinical investigation has indicated the possible presence of cancer. The puboprostatic ligament is severed and the lateral reflexion of fascia is incised. The index finger then may palpate the inferior portion of one half of the prostate. Wedge biopsy section by sharp incision or electrosurgical knife may be readily obtained. Tissue biopsy by this method has been used quite successfully in our clinic, followed by radical prostatovesiculectomy or by retreat to intracapsular enucleation when suspected areas of induration are found to be free of cancer. The instances when suspected cancer has by frozen section been determined to be fibrosis or occasionally calculus disease of the prostate subtotal prostatectomy has been done with considerable ease. In one case in which a nodule was suspected in a young man with no evidence of prostatism a biopsy section was readily obtained, found to be negative, and the capsule closed by sutures without resort to other prostatic surgery. Such patients usually recover very rapidly and without complications.

Periprostatic and rather extensive extravesical pelvic exploration may accompany investigation of known or suspected instances of cancer of the prostate.

A very definite limitation is imposed by the perineal approach in this respect and exploration for soft tissue and lymph gland metastasis may be only adequately made through the anterior incision. We have found instances of involvement of the regional lymph glands with no roentgenologic evidence of cortical bone involvement. It is possible to palpate the seminal vesicals without appreciable disturbance of the prostate and to determine the possibility of involvement of these structures at a relatively early phase of the operative procedure.

One interesting case of cancer of the prostate was encountered which, by digital examination, demonstrated questionable evidence of neoplastic changes in the gland. Pyelographic studies, however, demonstrated an indentation of a portion of the lower third of the right ureter at approximately the level of the cecum. The anterior approach allowed verification of the tentative impression of cancer of the prostate. Further exploration through the incision allowed exposure of the lower portion of the ureter. The indentation was found to be caused by a lymph gland impinging upon the ureteral wall. Frozen sections of the gland clearly demonstrated prostatic carcinoma metastasis. In this series the approach for carcinoma of the prostate by the retropubic incision still is relatively small. The experiences quoted indicate that biopsy section is feasible and that digital exploration of the pelvis is an important factor.

Since it is not the purpose of this presentation to discuss in detail the surgical procedures we have employed, the actual steps of the radical retropubic prostatectomy will not be reviewed. Our surgical procedures rather closely parallel the recorded observations of Millin, Chute and others. Radical retropubic prostatovesiculectomy is not a simple procedure and is considered in our clinic to be more difficult technically than radical perineal prostatectomy, but as has been indicated certain advantages may outweigh the technical difficulties involved. Loss of blood may be a major factor as it is in many radical procedures. However, visible complete control of blood loss is possible and this of course should be mandatory in the interests of good surgical technic. Perhaps the most difficult phase of this operative procedure is the approximation of the prepared vesical neck to the membranous urethra. This may be extremely difficult in some instances where there is a deep and poorly exposed area with definite limitation of vision. This problem has been at least partially overcome by the use of perineal sutures as described by Chute. In the application of this maneuver sutures are placed through the vesical neck and carried through the urogenital diaphragm. They are tied externally in the perineum in such fashion that the urethra and bladder neck, which are splinted by a catheter, are closely approximated.

In some instances postoperative urethral calibrations are mandatory. The majority of patients have been continent although temporary stress incontinence is common. Complete and total incontinence apparently has not occurred in our small series. It is a fact that some of our patients continue to wear a male urinal to avoid embarrassment of stress incontinence. However we consider that the problem of continence following any type of radical prostatic surgery has been overstressed. Certainly occasional leakage or even total incontinence should not be considered of sufficient importance to outweigh the possibility of cancer

cure. The matter of urinary control always is discussed with the patient prior to operation, and by drawing a comparison with colostomy cases all of our patients have readily perceived that potential incontinence has been overstressed. Although no adequate conclusions may yet be drawn because of the small number of cases it is quite probable that the incidence of incontinence will compare favorably with the recognized rate following radical perineal operation.

A possible favorable feature is the ability to care for cancer of the prostate when coexisting with certain categories of bladder tumor, vesical calculus and other conditions, thus eliminating the need for an additional surgical procedure.

## SUMMARY

The retropubic or extravesical and anterior approach to diseases of the prostate gland has received extensive consideration at the University of Maryland Hospital. This operation for benign prostatic hypertrophy has been accepted as the procedure of choice in our teaching program, particularly as applied to general surgical house offices. The majority of all patients who have benign prostatic hypertrophy are now cared for by this operative procedure. Postoperative surgical care has been reduced to a minimum and the popularity of this procedure definitely is noticeable at the patient level. Complications are relatively infrequent. Hospital stay is nearly universally short.

Although it is not within the scope of this presentation to dwell in detail on surgical procedures, observations both casual and specific as related to the care of benign and cancerous lesions of the prostate have been presented. This means of treating the patient who has benign prostatic hypertrophy is enthusiastically endorsed. In our experience this approach is admirably suited to investigation, biopsy and removal of the early carcinomatous gland, including the removal of the seminal vesicles with ample opportunity to explore widely and, when desirable, to simultaneously correct coexisting lesions. The complication of osteitis pubis has not been a problem.

# ANESTHESIA FOR THE ELDERLY

ROBERT B. DODD, M.D.

*Baltimore*

This paper will be devoted to the consideration of some of the common problems in the management of anesthesia for the elderly patient. Modern anesthesia has been defined as "a reversible depression of the nervous system (general anesthesia) with loss of pain and consciousness, graded skeletal muscular relaxation, control of adverse autonomic reflexes and minimal interference with heat and fluid balance and with the activity of the other vital systems of the body."[6] That the "reversible" qualification in the definition is not always carried into practice has been pointed up very strongly in the recent paper by Beecher and Todd[1] of a five year study of deaths associated with anesthesia and surgery. They found that the anesthesia death rate, that is deaths for which anesthesia was directly responsible or an important contributing factor, was 1:1560 in patients receiving anesthesia in the 10 university hospitals that contributed to the study. When the anesthesia deaths were subdivided into age groups, it was found that 45.3 per cent of all the anesthetic deaths were occurring in the 35.2 per cent of the surgical population who were over 50 years of age (fig. 1). In this segment of the surgical population, the disparity between the anesthesia deaths, by per cent, and the surgical population, by per cent, grew greater as the patient's age increased, but the trend apparently started in the late *forties* or early *fifties*. If the definition of modern anesthesia were being followed closely in practice then the black bars in figure 1 should vary around the white bars much more closely than they do.

The problem of pediatric anesthesia is very apparent in the anesthesia mortality figures, but in absolute figures and in the general surgeon's practice, the problem of the older patient is and will be more common. Figure 2 is based upon population changes in the *over 60* age group in the city of Baltimore during the past century with a projection to the year 2000[7]. It follows that this general population trend will be reflected in the surgical population.

## PREOPERATIVE EVALUATION AND PREPARATION

The anesthesiologist, or the surgeon if he is responsible for the conduct of the anesthesia, must evaluate the patient on the basis of his physiologic age rather than his chronologic age and gauge the medication and the choice of anesthesia accordingly. The choice of anesthesia will depend upon the patient's general condition, the site and extent of the surgery, the duration of the proposed surgery, the finesse of the surgeon, and the capabilities of the anesthetist.

*The Cardiovascular System.* It should be taken as fact that all elderly patients have some cardiac impairment and diminution of reserve. Autopsies on geriatric

From the Department of Anesthesiology, University of Maryland School of Medicine and the University Hospital, Baltimore, Maryland.

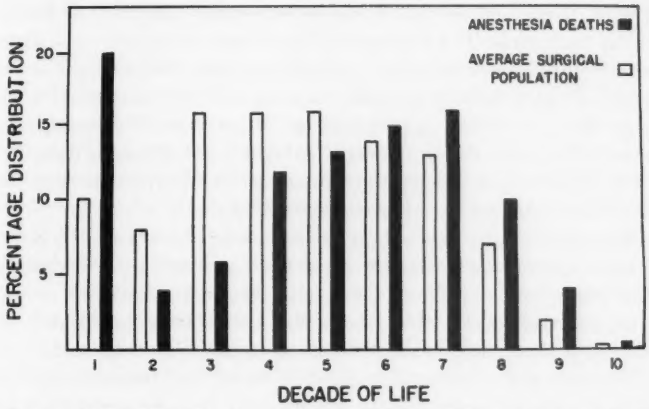


FIG. 1. Bar graph based on data given in Beecher and Todd's report on anesthesia deaths.

patients show constant findings of varying degrees of cardiac valvular defects and coronary sclerosis with myocardial fibrosis. They should be handled with the same degree of care as are those with known cardiac conditions. Because of arteriolar sclerosis they are not able to compensate well to hypotension, whether it is caused by frank blood loss or pooling of blood as a result of spinal anesthesia.

Which geriatric patients should be digitallized prophylactically? There is general agreement that all patients who are in *failure* should be digitallized preoperatively. Most authorities agree that if a patient has ever had an episode of *failure*, he should be digitallized to protect the heart against the additional strain of anesthesia, surgery and intravenous fluids.

Patients who have clinical coronary disease should be handled with special care to prevent anoxia or hypotension. When possible, surgery should be postponed for at least three months following a myocardial infarction[3]. If surgery is

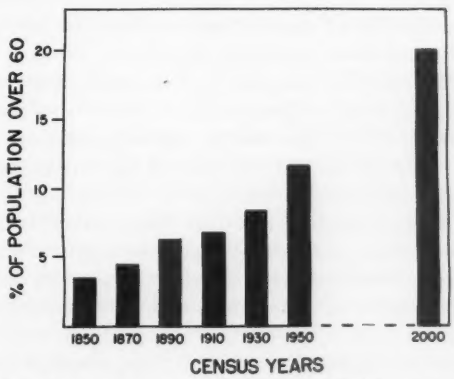


FIG. 2. Bar graph based on census statistics for City of Baltimore for years 1850 to 1950.

done less then three months following an infarction, the risk probably is increased about twelvefold. If a myocardial infarction occurs during surgery or in the immediate postoperative period, the chances are nearly three out of four that the patient with known coronary disease will not survive. Probably all patients over 45 years of age upon whom major surgery is contemplated should have electrocardiograms. Preoperatively, it might point out some danger signals. Later, it will constitute a valuable guide to correct interpretation of *suggestive* findings in electrocardiograms taken postoperatively.

*The Respiratory System.* Prevention of respiratory obstruction is part of the anesthetic management for a patient of any age but may be particularly bothersome in the elderly patient. When the elderly edentulous patient's dentures are removed, the lips and cheeks often sink in on inspiration. This obstruction interferes with respiration and is tiring to the patient. This may occur following therapeutic doses of depressant drugs. The somnolent sedated patient may tolerate a small oropharyngeal airway, occasionally trying to extrude it with his tongue, occasionally chewing on it, but in the meantime doing better than he did without it. If the patient is under anesthesia and the obstruction cannot be relieved by an oropharyngeal or nasopharyngeal airway, the anesthetist should insert an endotracheal tube to bypass the obstruction.

One of the more common surgical emergencies in elderly patients is intestinal obstruction. If the intestine has not been completely decompressed, an endotracheal tube with an inflatable cuff should be passed at the beginning of anesthesia before a laparotomy is done.[4] The cuff, when inflated, will tamponade the glottis against aspiration of gastric contents which might cause sudden death or a postoperative pneumonitis.

In the elderly patient, there nearly always is a certain degree of emphysema and pulmonary fibrosis. The exchange of carbon dioxide and oxygen is slower and more physical effort is required to pull the air in and push it out than in patients with younger more resilient lungs. Inhalation anesthesia is best given by open or semiclosed technics utilizing high flows of gases to overcome resistances in the anesthesia machine. If a closed system of anesthesia is necessary, the to-and-fro method of carbon dioxide absorption may be preferable to the more commonly used circle absorption unit.

*The Liver and Kidneys.* The changes in these organs, both intrinsic and secondary to generalized vascular changes, plus lowered body metabolism and, often general debility, make the elderly patient particularly susceptible to depressant drugs. Doses one-half to one-third of the average adult dose usually will suffice to produce the desired effect.

For the patient with severe liver or kidney disease, there seems to be no ideal anesthetic agent or technic. Intercostal nerve block plus nitrous oxide oxygen analgesia provides good surgical conditions for laparotomy. Some anesthetists and surgeons prefer segmental spinal or continuous extradural block for this type of patient.

*Fluids, Electrolytes and Blood Volume.* Since the preoperative preparation of the patient to correct nutritional deficiencies usually is within the province of

the surgeon or internist, discussion of this facet will be limited except to make two points.

1. Practically all elderly surgical patients have significant deficiencies in blood volume.[2] A lowered blood volume makes the patient an extremely poor candidate for anesthesia and surgery. Spinal anesthesia may be lethal because of the pooling of the small quantity of available blood. Under general anesthesia the blood pressure progressively falls and the pulse pressure characteristically narrows. If facilities are available, blood volumes should be measured on all elderly patients prior to major surgery. Where this is not possible, several transfusions given preoperatively will allow the patient to withstand the effects of surgery and anesthesia much better. From the anesthetist's standpoint, the massive replacement of this preoperative blood volume deficit at operation constitutes a very ticklish problem. When hypotension is induced by the effects of anesthesia and low blood volume, how much blood can be given safely without overloading the circulation?

2. Even in acute emergencies, time must be taken to overcome severe fluid and electrolyte deficit. The elderly patient, if severely dehydrated, will withstand the rapid administration of intravenous fluids because the fluid will be utilized rapidly. Usually, in such cases, 1500 cc. of intravenous fluids may be given at the same rate of infusion as in a younger patient.[8] Thereafter, the patient usually begins to excrete urine and the intravenous flow can be slowed to a rate not to exceed 500 cc. per hour. This problem is particularly acute in the patient with a perforated viscus or intestinal obstruction. If the fluid deficit and salt deficit is not replaced, the patient responds to anesthesia with hypotension (or may be hypotensive without anesthesia). If the hypotension is presumed to be from blood loss or anemia and the blood loss is replaced by whole blood, the circulation may be overloaded with resultant cardiac decompensation or a condition described as *congestive atelectasis*.[5]

## SPECIAL CONSIDERATIONS

*Surgical Position.* Few surgeons have assumed the extreme surgical positions to which their patient sometimes are subjected for reasons of *exposure of the operative field.* If they did, they might experience vertigo, dyspnea or a combination of both, plus pain. These adverse effects can be controlled to some extent by the anesthetist, but not always for prolonged periods.

Some common surgical positions are here listed: Better positions for the patient are designated by parentheses. They are the jack-knife position for rectal work (Sims position), extreme Trendelenburg (extreme Trendelenburg for short periods only, otherwise flat or 5 to 10 degrees head down), lateral position with kidney bar (inflatable bag under the patient plus or minus slight table break), and extreme lithotomy plus Trendelenburg (less of each when position is indicated, it is the most obstructive to respiration of any position used).

*Duration of Operation.* This is the surgeon's decision. Consideration must be given to the time taken for the operation in relation to the patient's general condition and the patient's life expectancy, whether palliation or a conservative

effort at cure will be better than a radical procedure. This decision often is made while surgery is in progress and requires the utmost cooperation and honesty between the surgeon and anesthetist and consideration for the patient and his family.

## PREMEDICATION

Preoperatively, the patient's attitude should be conditioned to a hopeful outlook. The premedication should abet this tranquillity. Consideration should be given to whether obtunding of pain or sedation and amnesia are the aims for the particular patient. The depressant effects of opiates and their synthetic substitutes parallel their analgesic properties.

In the absence of pain, either chloral hydrate (0.25 to 0.5 Gm.) or a short acting barbiturate (50 mg. to 100 mg.) usually provides adequate sedation. Barbiturates may produce disorientation and should be used with caution. Where general anesthesia is contemplated, atropine sulfate, 0.3 mg. to 0.4 mg., should be given intramuscularly one hour preoperatively for its drying effect and protection against noxious reflexes. Scopolamine may cause excitement, delirium and restlessness in the elderly patient.

Where pain is present or the anesthetist desires respiratory depression, morphine (5 mg. to 10 mg.) or Demerol (25 mg. to 75 mg.) may be used, or comparable dosages of other analgesics.

It is best to err on the side of too light premedication. The premedication can be supplemented intravenously in the operating room if necessary.

## CONDUCT OF ANESTHESIA

The elderly patient usually willingly accepts block anesthesia. Although local anesthetic drugs produce more reactions in the aged, the advantages of regional anesthesia far outweigh its disadvantages. For example, brachial plexus block for upper extremity surgery, and sciatic and femoral block for surgery below the knee usually suffice without general anesthesia supplementation. Intercostal nerve block with light cyclopropane anesthesia or nitrous oxide analgesia is excellent for laparotomy. The practice of *going as far as possible under local* is to be condemned. A definite plan for the conduct of anesthesia should be scheduled before the operation is started. If local anesthesia is to be used, it should be considered the primary agent and every effort should be made to get a successful block suitable for the contemplated procedure.

Spinal anesthesia in the properly prepared patient is excellent for operations that can be performed with levels below the tenth thoracic segment. This includes most urologic procedures (3 to 6 mg. of pontocaine for transurethral procedures, 6 to 10 mg. of pontocaine for suprapubic procedures), orthopedic procedures on the hip and lower extremity (4 to 6 mg. of pontocaine) and hernias and bowel work if the surgeon is gentle (6 to 10 mg. of pontocaine). The preceding dosages are for hyperbaric solutions and it is assumed that the patient will be positioned for maximal concentration of the drug at the nerve segments innervating the operative area.

Where general anesthesia is required, inhalation technics are best. Small doses of intravenous barbiturates may be given to provide a smooth induction but thereafter the patient should be kept asleep by nitrous oxide-oxygen mixtures (with oxygen concentrations no lower than 30–40 per cent) or nitrous oxide-oxygen-ether mixtures which will allow a higher oxygen concentration and better analgesia. The semiclosed technic utilizing high flows of gases is preferred. Where a closed technic is necessary, ether anesthesia usually is preferred. If the patient's condition is particularly precarious, cyclopropane often is used because the patients emerge so rapidly from its effects. Relaxation should be provided by nerve block of the operative site so that the patient may be carried in light anesthesia.

Relaxant drugs should be used with extreme caution, if at all, in these patients. Prolonged respiratory depression following their use is seen most commonly in the elderly. Succinylcholine chloride probably is the safest of these drugs because of its evanescent effect. If used, it should be administered in small (10–20 mg.) doses intravenously when relaxation is necessary. The use of constant intravenous infusion of succinylcholine in these patients is dangerous because overdosage may occur, particularly in prolonged surgery.

## SUMMARY

Anesthesia deaths are disproportionately high in the older age groups. The same precautions should be taken in the elderly patient as are taken in the known cardiac patient. Adequate preoperative preparation usually is the most important factor in taking these patients through operation successfully. During operation, extreme operative positions should not be used, or used only for short periods of time during crucial portions of the operation. Inhalation anesthesia, when necessary, should be administered by semiclosed or open methods, utilizing high flows of gases. Low spinal anesthesia is recommended for certain procedures. The use of regional anesthesia, whenever feasible, is urged either as the sole technic or as supplement to general anesthesia. The use of intravenous anesthesia and relaxants in these patients is questioned.

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# KYPHOSCOLIOSIS WITH PARAPLEGIA*

JAMES G. ARNOLD, JR., M.D.

*Baltimore*

THOMAS B. DAMERON, JR., M.D.

*Raleigh, N. C.*

Congenital and idiopathic kyphoscoliosis occasionally are the cause of paraplegia. This deformity of the spine is not uncommon, but the relatively small number of reported cases associated with paraplegia indicates the relatively uncommon association of kyphoscoliosis and paraplegia. The excellent results which can be obtained by surgical treatment in the majority of patients prompt us to report 2 cases which have come under our observation.

The first case occurred in a patient with cleidocranial dysostosis, a hereditary disease characterized by a deficient formation of the clavicles, and delayed, imperfect ossification of the cranium. The pelvis, upper femora, hands, feet, and neural arches of the vertebrae frequently are found to be abnormal in this condition. Scoliosis is considered only as an exceptional accompanying deformity. We have been unable to learn of any previous case of kyphoscoliosis and paraplegia associated with cleidocranial dysostosis.

## CASE REPORTS

Case 1. N. S., a 20 year old white man was admitted to the Children's Hospital School on the service of Dr. George E. Bennett on Jan. 4, 1953, because of weakness and numbness in his legs. When he was 6 years old he was noticed to have a limp and a lateral curvature of his spine. He was examined by a physician and found to have "a dislocated hip and scoliosis"; however, he received no treatment for either. Although the scoliosis progressed, the boy remained active. He played baseball and basketball with his school friends as late as nine months prior to admission. At this time he first noticed a weakness in his legs, which gradually progressed; he had to use a cane and later crutches. Five months after the onset of this weakness he was admitted to a university hospital. After 18 days' study he was advised not to have surgery or any other therapy. He returned to his home and grew progressively worse. He was able to sit propped up in a wheelchair and could stand unaided only momentarily. There was increasing urgency on urination.

The patient's maternal great aunt had curvature of her spine. Her brother, the maternal grandfather, was examined and found to be normal. We examined and took roentgenographic skeletal surveys of the patient's parents, his eight sisters, and six of his nieces and nephews. No abnormalities were found in the father. The mother has defects of her right clavicle, supernumerary teeth, prognathic mandible, underdeveloped symphysis pubis, and a mild (15°) scoliosis. The oldest sister had absence of the lateral one-half of her right clavicle, and the other characteristic deformities of cleidocranial dysostosis; she did not have any scoliosis. The second and third daughters were normal. The fourth daughter had cleidocranial dysostosis and bilateral congenital dislocated hips, but no scoliosis. The next daughter was found to have no abnormality. The three sisters younger than the patient

* From the Children's Hospital School and the Division of Neurological Surgery, University of Maryland School of Medicine.

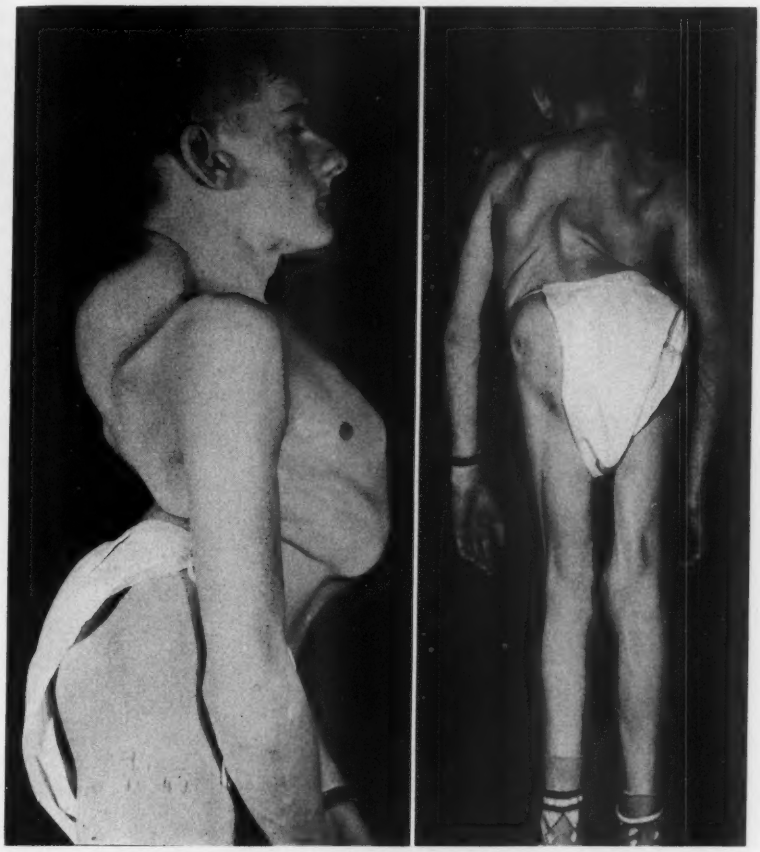

FIG. 1. Case 1. Photograph of patient shortly before operation showing marked degree of kyphoscoliosis.

all had cleidocranial dysostosis. Two had coxa valga and one, acetabular dysplasia. One had a scoliotic curve of 135°, one 45°, and the youngest (7 years old) had no abnormal spine curvature. All six of the nieces and nephews were found to be normal.

The patient appeared much younger than his actual age. He had a marked relative shortening of his trunk due to a kyphoscoliosis of the upper thoracic spine (fig. 1). He had a slight prognathism. The lateral parts of the clavicles were absent and there was a marked hypermobility of the shoulders anteriorly. Both trochanters were abnormally high. The neurologic status of the upper extremities was normal. The lower extremities showed paraplegia in extension with marked increase in extensor tone including adductor spasm. The plantar responses were extensor, and there was bilateral sustained ankle and patellar clonus. Muscle check showed loss of function, approximately 65 per cent, in the muscles of the lower extremities. Flexion of the hips was possible but not against resistance. A flicker of motion was present in the extensors and flexors of the great toe. A flexor withdrawal response was present in both lower extremities. There was hypalgesia from the fifth thoracic to the eighth thoracic with almost complete analgesia below the eighth tho-

FIG. 2. Case 1. Roentgenogram of spine showing the degree of scoliosis

racic. Position sense was defective in the toes of both feet. Light touch and tactile localization were normal.

Roentgenograms of the skull showed the suture lines to be open, Wormian bodies, an absence of mastoid air cells, and supernumerary teeth. Roentgenograms of the spine with the patient supine showed a 120° scoliosis (fig. 2). This was only 5° more curve than had been present two years before, which is interesting because at that time the patient had no signs of paraplegia. A 135° kyphos was present (fig. 3); we do not know how much kyphos was present two years previously. There was a spina bifida occulta from the second cervical through the tenth thoracic vertebrae. The cervical vertebrae and spinal canal were abnormally wide. There was only a small median segment of bone visualized in each clavicle. The metacarpals had a stairstep appearance (fig. 4), the second being abnormally long and the fifth abnormally short. An extra epiphysis was present on the base of the second metacarpal. The distal phalanges were triangularly shaped. The bone age was much less than the patient's actual age of 20 years. The pubic bones were underdeveloped (fig. 4), the iliac crests being flattened in the anteroposterior view. There was a coxa vara on the right, and the left hip was dislocated. There was bilateral acetabular dysplasia.

A myelogram showed a complete block at the level of the seventh thoracic. On Jan. 14, 1953, a laminectomy was done from the third thoracic to the ninth thoracic. The bony exposure showed a cleft in the spinous processes due to incomplete fusion of the laminas in the midline. The clefts were bridged with fibrous tissue. The angle of the spinous processes is very similar to that seen in the cervical region. There was lateral angulation of ap-

proximately 1 centimeter. The anteroposterior angulation was extreme with its maximum point in this area showed it to be quite firm and lacking the normal resiliency; it was stretched tightly over the maximum point of angulation. Subarachnoid fluid was encountered below the eighth thoracic and above the third thoracic. When the dura was opened, its cut margins retracted immediately to the anterolateral side of the cord, indicating the degree of tension it was under. The cord had a noticeably blanched appearance in the region of the maximum angulation. Shortly after opening the dura, the capillary circulation appeared again. The cord was displaced to the right about 1 centimeter, and its right side was in close apposition to the lamina and pedicles. In this area, the pedicles were rongeured flush with the vertebral bodies. The dura was left open, and a layer of gelfoam was placed over the exposed cord.

Postoperatively the patient showed a flaccid paraplegia and was totally incontinent. After three months he began to improve slowly, and after five months could turn himself over. He was able to discontinue the catheter during the eighth postoperative month. His motor power and sensation returned much more quickly in the right leg than in the left. He was discharged from the hospital on crutches nine months after his operation. By the twelfth postoperative month he could walk a few steps by himself. When examined 15 months postoperatively he was asymptomatic and could walk as far as a half mile without resting. It is now 23 months since operation and he continues to do well.

Case 2. R. T., a 13 year old white girl was admitted to the Children's Hospital School, under the care of Dr. George E. Bennett on June 12, 1952. The child was born prematurely

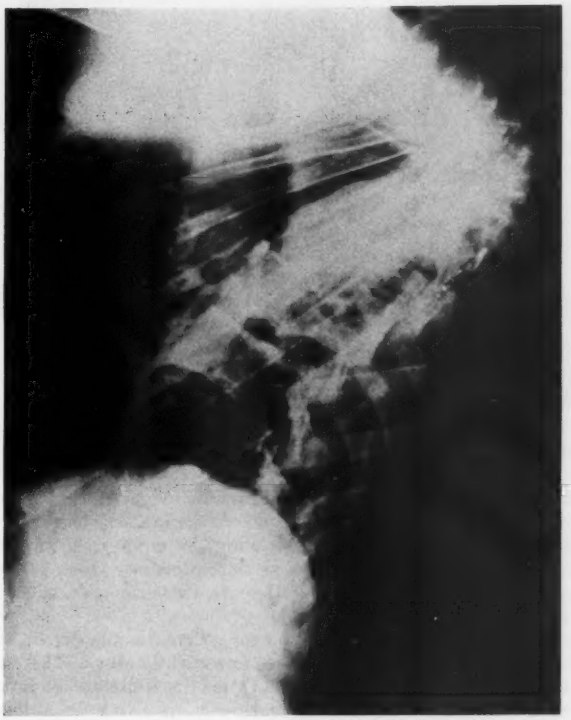

FIG. 3. Case 1. Lateral roentgenogram of spine showing the degree of kyphosis

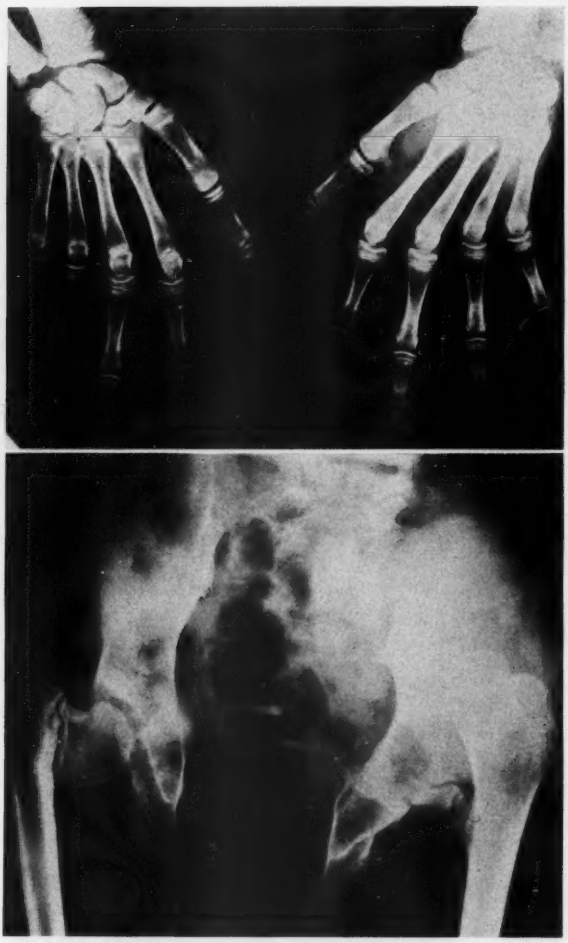

FIG. 4. Case 1. Roentgenogram of hands and pelvis. There is coxa vara of the right hip with dislocation of the left hip and acetabular dysplasia.

(7 months gestation). Delivery was normal, her birth weight being 3⅓ pounds. When she was 2 weeks of age, the mother noticed that her back gave the appearance of an "extra joint" in the upper portion of the vertebral column. The child walked and talked at the usual age, but as she grew, the "joint" became more prominent, soon giving her the appearance of being hump-backed. At the age of 11 years, she began to stumble, and her knees seemed to give away.

Examination showed a marked kyphos in the upper dorsal region (fig. 5). Mild weakness of the lower extremities was found, and the gait was slightly ataxic. There was moderate increase in tone of the adductors of the thigh, and there was a bilateral coxa vara deformity of both hips (fig. 6). A modified Taylor back brace was prescribed. Following discharge on July 10, 1952, the weakness in the lower extremities increased, and within a short time, she was unable to walk.

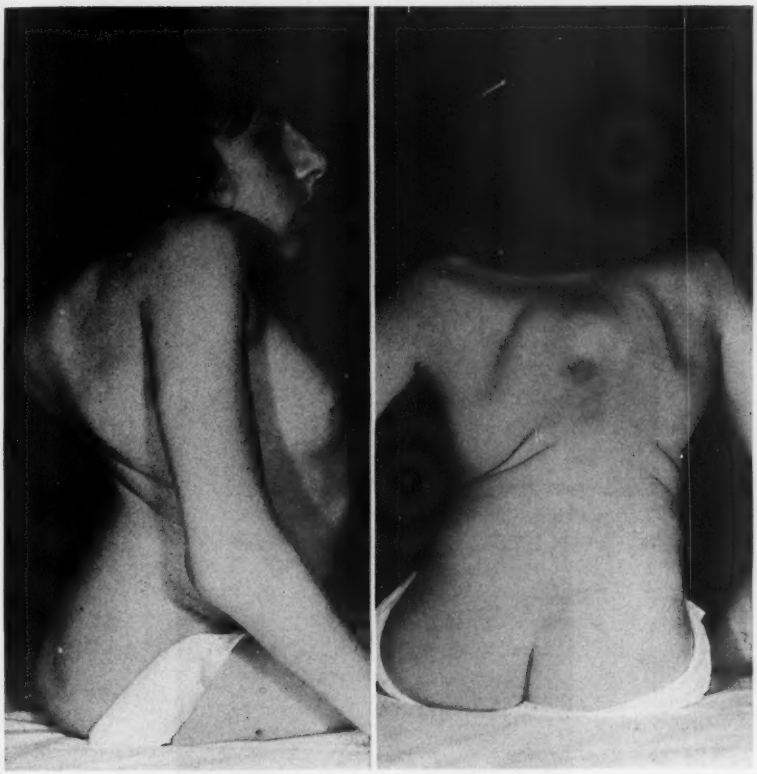

FIG. 5. Case 2. Photograph of patient preoperatively, showing the postural deformity

She was readmitted to the Children's Hospital School on May 17, 1954, following the gradual progression of her symptoms. She had been unable to walk for the past 18 months. Examination showed complete loss of function in the left lower extremity except for slight motion in the toes, and about 75 per cent loss of function in the right lower extremity; she was able to flex and extend the leg and thigh, but against no resistance. There was marked adductor spasm with moderate increase in extensor tone. Knee and ankle jerks were 4 plus, with bilateral ankle clonus. Babinski reflex was positive on both sides. Sensory examination showed loss of position-sense in both feet and hypoalgesia from the seventh thoracic to the first lumbar with areas of analgesia between the first lumbar and the third lumbar. The only symptom referable to the bladder was that the child would wet the bed occasionally. Anteroposterior and lateral roentgenograms showed a marked kyphos of the dorsal spine, with the apex at the level of the fourth thoracic (fig. 7); slight dorsal scoliosis also was present (fig. 8).

On May 27, 1954 under general anesthesia, laminectomy was done over the full extent of the kyphotic area, extending well above and below the maximum point of angulation. After removing the laminas, the dura was found to be stretched tightly, with the maximum point of angulation in the region of the fourth thoracic. The dura hugged the right side of the spinal canal, being closely applied to the pedicles; the left side of the canal was free due to the shift of the dura and cord to the right side. The laminas, pedicles, and facets were removed completely on the right. The dura presented a flattened appearance, and

FIG. 6. Case 2. Roentgenogram of pelvis showing deformity of both hips

FIG. 7. Case 2. Roentgenogram of spine showing marked dorsal kyphosis

when opened, its cut margins disappeared immediately to the anterior surface of the cord, indicating the considerable dural tension. The subarachnoid space was dry, and the cord appeared blanched. Shortly after opening the dura, circulation of the cord was much improved. The dura was left open, and a layer of gelfoam was placed over the cord.

Shortly after operation a Foley catheter was inserted, which was required for 10 days. On the tenth postoperative day, slight function was noted in the flexors of the leg on the left. Adductor spasm gradually diminished, and the plantar responses became flexor. Position-sense returned in the toes, and the hypalgesia improved rapidly. She was discharged on June 25.

FIG. 8. Case 2. Antero-posterior view showing the degree of scoliosis

Follow-up examination was done on Sept. 8, 1954, approximately three and one-half months after operation. The sensory status was found to be entirely normal. Motor power in both lower extremities showed sustained improvement, and on September 5, she had taken several steps without support. Very slight increase in tone was noticed in the adductors. Knee and ankle jerks were hyperactive. Ankle clonus was sustained on the right, and unsustained on the left. The plantar responses were flexor. She was able to extend and flex both legs against moderate pressure, and flex the thighs against gravity. She could bear weight and take several steps with slight support.

## DISCUSSION

The reader is referred to the excellent presentation of the subject by McKenzie and Dewar which was published in 1949.[6] They report 5 personal cases. The first patient in this series was operated upon by McKenzie in 1925. Thirty-six

TABLE I

*49 Cases reported to date*

| Authors | No. of Cases |
|---|---|
| Hyndman—1947 | 1 |
| McKenzie and Dewar—1949[6] | 41 |
| Love and Erb—1949[5] | 2 |
| Kleinberg—1951[3] | 1 |
| Kleinberg and Kaplan[4]—1952 | 1 |
| Kerr—1953[2] | 1 |
| Arnold and Dameron | 2 |

additional cases from the literature were reviewed, bringing the total to 41 reported cases to that date. Six additional cases have been reported, and the 2 reported in this paper bring the total to 49 cases (table I). Of the 49 patients, 32 were treated surgically. The types of surgical procedures employed in these patients were laminectomy with extensive permanent dural opening, division of the dentate ligaments and nerve roots, spinal fusion, and transplantation of the spinal cord. Enucleation and resection of one or more thoracic vertebrae have been reported by Wiles[7] and others, as an operative procedure designed to prevent the progression of kyphoscoliosis. Since none of the patients in these reported cases showed neurologic complications they have not been included in the tabulation.

Of the 49 reported cases, 32 patients were treated surgically and 17 conservatively. Of the 32 surgically treated patients, 23 obtained good to excellent results, 3 showed slight improvement, 3 were unimproved, and 3 died. The age of the patients at the onset of the paraplegia ranged from 6 to 38 years. Approximately 80 per cent of the patients ranged in age from 11 to 19 years. McKenzie and Dewar commented on the frequent occurrence in this latter age group by stating that "when paralysis occurs it usually develops during the years of most rapid growth, the tight dura being unable to accommodate itself to the rate of growth of the spinal column; cord compression is probably increased by narrowing of the dural sac by rotational displacement". The occurrence of uncomplicated kyphoscoliosis is more common in females, whereas the neurologic complications are more common in males.

The cause of the paraplegia in most patients is due to the longitudinal and lateral tension exerted by the dura on the spinal cord at the point of maximum angulation. One of the patients of McKenzie and Dewar had syringomyelia, and another showed a congenital membrane, which crossed the dura from side to side and compressed it. In a patient of Heyman (1937, referred to by these authors) the paraplegia was due to pressure by a spur of bone. In the majority of cases, the etiology of the kyphoscoliosis has been termed as congenital and idiopathic, but the deformity has been reported in association with neurofibromatosis and osteogenesis imperfecta. To this we have presented 1 case which is associated with cleidocranial dysostosis.

SUMMARY

Two cases of kyphoscoliosis with paraplegia are reported, 1 of which was associated with cleidocranial dysostosis.

A review of the literature reveals 47 comparable cases reported to date, the present 2 making a total of 49.

Early surgical intervention is the treatment of choice. Conservative measures generally are ineffective and may be harmful because of delay.

The authors wish to thank Dr. George E. Bennett for his permission and encouragement to report these cases.

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# A FEW THOUGHTS ON THE CLINICAL TEACHING OF SURGERY

WALTER D. WISE, M.D.

A commonly used expression in various relationships is that the pendulum has swung too far this way or that. Isn't it possible that, in teaching surgery to students, the pendulum has swung too far from the clinical and practical.

No one can possibly gainsay or discount the tremendous progress made in the science of surgery in recent years based largely upon better knowledge of physiology, biochemistry, and anesthesia. Is it not true, however, that there is danger of placing too much dependence on laboratory tests, as valuable as they are, and pushing aside good clinical observation in the fields of diagnosis and therapy. Surgery in a general hospital constitutes a high percentage of its activities. Are these activities being as fully utilized for the benefit of the students as they should be in hospitals connected with medical schools? Much surgery differs from medicine in its tempo, frequently being more urgent. Surgical patients are not, therefore, as a rule, as well adapted to study and teaching along the lines used in most medical cases (though medicine has its emergencies also). Because of this greater urgency, by and large, in surgical cases, it becomes necessary not only to make them more promptly available to students, or the students to them, but it is necessary to make diagnoses promptly. In such cases less time for extensive laboratory studies makes it more necessary that clinical observation be as sharp as possible to balance this loss. The first step in making a prompt clinical diagnosis is a good history and a critical analysis of it; the second step is a careful examination, then a correlation of the two. This sounds sophomoric but often one sees at the end of a long detailed history *rule out* this, that or the other, with mention of six or eight conditions, some of an acute nature, some chronic, some dangerous, others not. In many instances there is time for detailed study; in others there is not time. Someone has to make a decision and it may be necessary to do it immediately. This is when it becomes imperative to weigh every item in the history, symptoms and physical findings, the chronology, emphasis, lack of emphasis, shadings, *Indian signs*, hints of any kind, remembering that this is one place where two and two do not always make four.

Aristotle states that "lack of experience diminishes our power of taking a comprehensive view of the admitted facts . . . while those whom devotion to abstract discussions has rendered unobservant of the facts are too ready to dogmatize on the basis of a few observations".

Illustrations of the scientific outweighing the clinical are the following:

A highly trained doctor asked that an elderly woman be "seen sometime today" at home. He stated that she had a lump in her right femoral canal, with vomiting and constipation of three days duration, but he related that her blood chlorides were normal, her blood urea and urea nitrogen were normal, and her white blood count was not too high, so it could not be a strangulated hernia. That is what it was and resection was barely avoided. Within three months in the same patient with the same doctor, there was an exact repetition of the above

described situation with a strangulated hernia on the left side, with laboratory studies made while the patient was at home. The laboratory data obtained at a sacrifice of time almost nullified plain clinical evidence. This case is an exaggerated one but examples are all too numerous.

A patient had a well diagnosed chronic pancreatitis of many years duration, with a history of two laparotomies. He developed violent abdominal pain, vomiting, tenderness and distension. There was much discussion of an acute pancreatitis with the suggestion that blood sugar and amylase determinations be made. However, there was not a silent abdomen, as in acute pancreatitis, but violent peristalsis and, by careful palpation, in spite of the distension and exquisite tenderness, a mass in the lower abdomen could be felt. Immediate laparotomy was advised which showed adhesions, torsion of a section of the small intestine with gangrene of an 18 inch segment. Any further delay in this case might have resulted very seriously.

Per contra a good clinical evaluation may and often does call for laboratory studies:

An elderly woman, with a history of a functionless left kidney had been ill three days with severe right sided abdominal pain, vomiting, with tenderness in the right lower quadrant, abdominal distension and high fever. The urinalysis was considered negative; the low urine output had not been noted at this time. *She was slightly delirious.* She did not have signs of general peritonitis and no mass of any kind could be felt. However, a tentative diagnosis of a ruptured appendix was made. The slight delirium was an important symptom. Delay and further studies were advised, resulting in showing a stone in the right ureter blocking her only good kidney. A laparotomy would have put the operator in the wrong field. Her history and clinical evidence showed a clear need for further laboratory data and roentgenologic studies.

The above named cases are rather simple illustrations of the necessity of evaluation of the clinical findings. In 2 instances the history and clinical evidence were sufficient to demand prompt operation. In the third they were sufficient to prevent an emergency laparotomy and to call for further study. The point is that critical analysis of the history and findings should be given their full weight. They should not be considered casually, but should be the basis for determination of the safety of delay for further studies or prompt action, because delay would be the more dangerous alternative.

Surgery for the most part is therapy. Granting that there are difficulties in teaching surgery that are not present in the teaching of medicine, are we keeping pace with the medical departments in teaching students surgical therapy or are we relying too much on house officer training? Of course, major procedures in surgery are not under discussion here but one thinks of the responsibilities assumed July 1 each year by the doctor who was graduated a month or less prior to this date. In this short interval between graduation and assuming house officer duties, he probably has passed his State Board and it is legal for him to do anything his conscience and hospital regulations permit. In other words, his Medical School and the State have certified that he is a qualified doctor. Yet how

inadequate he feels in the emergency department; in detailing orders for preoperative and postoperative care or acting as second assistant in the operating room. Are we spending too much time in the fourth year in academic discussions and too little on practical, even manual, procedures? In the first aid handling of fractures the recent graduate is all at sea until he learns as a house officer. His first thought is a roentgenogram and he is apt to order one immediately, even in fractures of the middle portions of long bones, many times before sufficient splinting has been done to maintain the position he will see in the picture. However, he is very well informed on fluid balance, blood chemistries, liver function tests, and other laboratory procedures.

He expects the nurses to know a great deal about medicine and surgery but he knows practically nothing about nursing care. A few lectures on this subject by a tactful lecturer well might be added to the medical school curriculum.

So elementary a thing as proper bandaging is almost a lost art.

Also is not there a word to be said for the now frowned upon operative clinic? There is the argument that the student cannot see what is being done in the operations. This is true but he will not be doing the operations for a year or two or three and will, in the meantime, become intimately acquainted with them as a house officer. However, the fourth year student can see in an operative clinic many things that will be of value to him a few months later. In even the commonplace operation there is a great ritual on the part of all concerned,—the nurses, the anaesthetist, the house officers, and the surgeon. This ritual should become familiar to the senior student. He can see almost all of the duties of the second assistant in whose place he will shortly be placed. He can see the difficulties of surgery—that it is not all as easy as shown in moving pictures. In special operations he will see special instruments and technics. In fracture cases he can see the type of first aid that has been given, then the definitive treatment, including how to apply special splints or plaster casts. Apparently he is not getting enough of this training in the dispensaries. Furthermore, where but in the operating room can the students see *living* pathology stressed so emphatically years ago by Sir Berkely Moynihan? Certainly not in the autopsy room and not even in the pathology laboratory. Some important pathology does not reach either of these laboratories and when it does it is not in the living patient where it has to be considered surgically.

Granted that service as a house officer is depended upon for the training of surgeons, does the rotator, who is going into internal medicine see in his rapid whirl enough breasts or thyroids to give his patients proper advice? Shouldn't he also see all possible while a student before, during and immediately after operation? The same applies to many other conditions. This is not an argument for return to the numerous operative clinics of a few years ago, but for the inclusion in the schedule of more than currently recommended.

Not strictly along the lines of the clinical versus the too highly scientific but in the field of giving the student more information and wider coverage, it is suggested that another instance in which the pendulum may have swung too far is in the pushing of small group teaching. Its advantages under many cir-

cumstances are recognized, but there may be reasons to consider modifications. A surgical teacher, not paid in most instances, has a masterful lecture on head injuries, another teacher has one on thyroid conditions, another on parathyroid diseases and so on. Can they be asked, or will they have the enthusiasm, to repeat 8 or 10 times these lectures in 8 months or shall one small group of 10 or 12 students hear this presentation and the rest of the class miss it? Surgery is a tremendous subject; it is hard to cover the field once much less 8 or 10 times. Aren't courses to large groups easier to organize with less chance of omissions of important subjects?

It is recognized that much of this will be considered reactionary but remember the swing of the pendulum.